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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 14, NUMBER 2
JANUARY 15, 1981

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the Office of Water Research and Technology,
U.S. Department of the Interior

VOLUME 14, NUMBER 2
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W81-00251 -- W81-00500

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Office of Water Research and Technology. The cumlative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE OFFICE OF WATER RESEARCH AND TECHNOLOGY DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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05 WATER QUALITY MANAGEMENT AND PROTECTION

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

BOUNDARY MIXING IN DENSITY-STRATIFIED FLUIDS,
California Univ., Berkeley.
G. N. Ivey.
Phd Dissertation July 1980. 123 p, 40 Fig, 4 Tab, 52 Ref. (California Water Resources Center Project UCAL-WRC-W-525).

Descriptors: *Boundary processes, *Vertical migration, *Turbulence, *Density, *Stratification, *Mixing, Oceans, Hypolimnion, Epilimnion, Flux, Lakes, Physical properties, Dyes, Pycnocline.

A knowledge of mixing processes in the world's natural water bodies is vital to understanding many aspects of water quality control. These water bodies are commonly density-stratified and the stratification inhibits the mixing processes. One proposed and as yet poorly understood mechanism of mixing in density-stratified fluids is caused by turbulence at boundaries which cross isopycnic surfaces. This study utilizes a laboratory experiment to investigate a simple example of such mixing. Dye observations suggest that very little vertical mixing occurs in the interior as a result of the intrusions. The net vertical mass flux, which is both observed and measured in the experiment, is accompanied by a gradual change in the vertical density distribution. The dependence of the net vertical mass flux on several parameters is measured and the results are compared with the existing models of boundary mixing. (Garrison-Omniplan)
W81-00390

A BIOLOGIST'S VIEW ON THE ROLE OF WATER CHEMISTRY IN ENVIRONMENTAL ASSESSMENT,
Department of Indian and Northern Affairs, Ottawa (Ontario).
E. K. Langtry.
In: Proceedings of the Technology Transfer Workshop, Environmental Impact Assessment in the North, Oct 31, Nov 1-2, 1978. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 1, p 14, 127-138, 1979. 2 Fig, 2 Tab, 1 Ref.

Descriptors: *Environmental impact assessment, *Arctic, *Northern development, *Environmental effects, *Water chemistry, Water quality, Limnology, Water properties, Biological properties, Sampling, Water analysis, Canada.

Water chemistry is important for environmental assessment purposes, but traditional studies have often failed to assist in impact predictions. Biological analysis by itself does not define water quality precisely and should be correlated with water chemistry. The variability in chemical data can be controlled and identified with suitable study schemes. Proper sample handling and analyses by trained chemical technicians will eliminate variance due to human error. The variability characteristic of natural waters, both temporally and spotially, can be accurately estimated by careful selection of sampling frequencies and good network design. Chemical studies will achieve their maximum value when they are integrated with research in other environmental disciplines. A thorough understanding of ecological processes can be gained through intensive research on selected aquatic systems, rather than by reconnaissance type inventorying. The predictive capability that will be generated from modelling exercises will improve the quality of environmental impact evaluations. (WATDOC)
W81-00462

1B. Aqueous Solutions and Suspensions

ANALYSES OF WATER, BANK MATERIAL, BOTTOM MATERIAL, AND ELUTRIATE SAMPLES COLLECTED NEAR BELZONI, MISSISSIPPI (UPPER YAZOO PROJECTS),
Geological Survey, Baton Rouge, LA. Water Resources Div.
D. B. Brightbill, and J. B. Treadway, Jr.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO. 80225, Paper copy $2.25, microfiche $4.00. Geological Survey Open-File Report 80-758, July 1980. 11 p, 1 Fig, 1 Plate, 4 Tab, 11 Ref.

Descriptors: *Water analysis, *Water quality, *Core drilling, *Bottom sediments, *Chemical analysis, Dredging, Flood control, Heavy metals, Pesticides, Physical properties, Sediments, Particle size, Hydrologic data, Mississippi, *Upper Yazoo projects.

Four core-material-sampling sites and one bottom-material site were chosen by the U.S. Army Corps of Engineers to represent areas of proposed dredging activity along a 24.9-mile reach of the upper Yazoo River. Five receiving-water sites also were selected to represent the water that will contact the proposed dredged material. Chemical and physical analyses were performed upon core or bottom material and native-water (receiving-water) samples from these sites as well as upon elutriate samples of the mixture of sediment and receiving water. The results of these analyses are presented without interpertation. (USGS)
W81-00355

PARTICULAR SOLUTIONS TO THE PROBLEM OF HORIZONTAL FLOW OF WATER AND AIR THROUGH POROUS MEDIA NEAR A WETTING FRONT,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 7B.
W81-00496

2. WATER CYCLE

2A. General

HYDROLOGIC DATA FROM UPPER GRANGE HALL CREEK BASIN, NORTHGLENN, ADAMS COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-00366

BASIN STUDY: BATHURST ISLANDS, 1976,
Water Survey of Canada, Ottawa (Ontario).
J. H. Wedel.
In: Proceedings of the Technology Transfer Workshop, Environmental Impact Assessment in the North, Oct 31, Nov 1-2, 1978. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 1, p 15, 141-144, 1979.

Descriptors: *Watersheds, *Hydrologic data, Runoff, Sedimentation rates, Snowmelt, Mathematical models, Flow, Sediment transport, Sediment yield, Waterbudget, *Bathurst Island, *Arctic, Canada.

An intensive basin study on Western Bathurst Island was undertaken in year two of the Arctic Islands pipeline study. The basin was situated in region of fairly uncohesive soils and little previous hydrologic data. The field program assembled meteorologic, hydrologic and sediment data for the runoff period in 1976. Subsequent analysis produced an empirical relation of runoff derived from resolute bay precipitation data, some mathematical models describing snowmelt, streamflow and sediment discharges, and values in a water budget for the basin. The results indicated that annual runoff and sedimentation rates were greater than those shown in the current hydrologic atlas. (WATDOC)
W81-00463

2C. Snow, Ice, and Frost

SPATIAL SIMULATION OF SNOW PROCESSES,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
A. G. Thomsen, and W. D. Striffler.
In: Proceedings Symposium on Watershed Management, Boise, Idaho, July 21-23, 1980. Vol I, p 326-334, (1980). American Society of Civil Engineers, New York, NY. OWRT-B-160-COLO(4), 5-31640.

Descriptors: Snow, Remote sensing, *Spatial distribution, *Model studies, *Snowfall, *Snowmelt, Watersheds(Basins), Snow cover, Moisture content, Streamflow, Topography, Vegetation, Soils, *Colorado, Rocky Mountains.

A spatially distributed model for the simulation of snow accumulation and melt in the Central Rocky Mountains in Colorado is discussed. Snow processes are simulated within square (5.76 ha) grid cell elements. Parameter decks for operating the simulation model on specified watersheds are generated automatically from watershed information (topography, vegetation and soils) in digital terrain models. The computer program that generates the parameter deck, has calibration options for all major processes which permits model calibration on watersheds with varying characteristics within the region. The hydrograph resulting from spring snowmelt is simulated by a lateral flow model of streamflow generation driven by the spatially distributed input (snowmelt + rain). Parameter decks for operating the lateral flow model are likewise generated automatically from digital terrain models. Line printer generated map overlays, showing simulated snowcover parameters (depth, temperature) as well as the moisture content of the rooting zone, can be produced for any date between April 1 and July 31.
W81-00381

GLACIER SURVEYS IN BRITISH COLUMBIA - 1978,
Inland Waters Directorate, Ottawa (Ontario).
I. A. Reid, and I. O. G. Charbonneau.
Report Series No 66, 1980. 23 p, 9 Ref, 39 Tab, 8 Fig, Maps.

Descriptors: *Glaciers, *Surveys, *History, *Aerial photography, Topographical maps, British Columbia, Alberta, Hydrological studies, Stereoscopic terrestrial surveys, Water supply, Snowmelt, Water storage, Streamflow, *Canada.

Glaciers act as natural regulators, storing water in winter and releasing it in summer. To gain some understanding of this phenomenon and the contribution which glaciers make to streamflow, the predecessors of the Water Survey of Canada began glacier surveys in 1945. The earlier surveys offered some clue to the role of the glacier, but the data collected were not sufficient to provide the overall picture. Following adoption of photogrammetric survey techniques, however, the glacier surveys have evolved to the extent that it is now feasible to produce a series of maps from which the linear, areal, directional and volumetric changes can be determined. The surveys have revealed that the glaciers, in general, are becoming smaller in size; hence the regulating effect on streamflow is dimishing. (WATDOC)
W81-00385

CREEP AND GLIDE PROCESSES IN MOUNTAIN SNOWPACKS,
National Hydrology Research Inst., Ottawa (Ontario).
D. M. McClung.
NHRI Paper No 6, 1980. 66 p, 19 Fig, 32 Ref, 1 Tab.

Descriptors: *Avalanches, *Snowpacks, *Physics, *Models, *Velocity, Snow pressure, Shear stress, Strain rates, Snow pressure, Poisson ratios, Creep, Glide, Deformation, *Canada.

Creep and glide processes in mountain snowpacks are discussed from the point of view of relevant constitutive equations for internal deformation (creep) in the material and slip boundary conditions (glide) at the base of slabs or the entire snowpack. The emphasis on the creep equations is to attain a formulation which is easily applicable in problems and which matches the known characteristics of field data rather that the most general equation. For glide, constitutive equations relating drag shear stress, tau, to slip velocity are given for three mechanisms for neutral zone conditions and a step toward the formulation of a general theory of snow gliding is made. Non-neutral zone glide boundary conditions are also introduced, and these are related to release of full depth and wet slab avalanches and to the problem of snow pressure on avalanche defence structures. Porous media effects on glide are also discussed. (WATDOC)
W81-00387

DISCUSSION ON SNOWMELT,
Waterloo Univ. (Ontario). Dept. Systems Design.
P. Baracos.
In: Proceedings of the Technology Transfer Workshop, Environmental Impact Assessment in the North, Oct 31, Nov 1-1, 1978. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 1, p 16, 147-155, 1979. 8 Ref.

Descriptors: *Environmental impact assessment, *Arctic, *Northern development, *Environmental effects, *Snowmelt, Measurement, Mathematical models, Runoff, Stochistic models, Equations, Canada.

Runoff generated from snowmelt constitutes the bulk of yearly flow in the north. Prediction of runoff volumes and their temporal distribution can be obtained from measurements of snow quantity and by modeling melt processes. Such predictions are important to water related developments, to environmental impact assessment, to estimated missing hydrometric data and to extend existing records. AES snow gauges undercatch snowfall in the barren lands and the relocation of snow by drifting is not addressed. Snow surveys, prior to runoff, supply accurate water content data provided that snow courses are designed to sample basin terrain units in a representative way. Snowmelt models may be explicit of implicit and based on meteorologic parameters in a heat balance model or be based on empirical, simple regress ion models tailored to fit site-specifics: (1) identifying the best model type, (2) estimating model parameters and (3) diagnostic checking. New computer programs make the 3-stage process quite straightforward. Intervention analysis by means of stochastic models promises to be a most useful tool in impact assessment. A transter-function model relating runoff time series to precipitation and temperature is currently under development for the implicit modelling of snowmelt. The akaike information criterion provides a useful, unbiased criterion for model selection. The criterion considers goodness of statistical fit and model simplicity. (WATDOC)
W81-00464

ICE JAMMING CONCERNS AND OPERATIONAL SOLUTIONS,
Inland Waters Directorate, Halifax (Nova Scotia).
E. R. Langley.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 198-210, 1980. 4 Ref.

Descriptors: *Flood risk mapping, *Ice jams, *Hydrologic data, *Model studies, *Flood control, Recurrence intervals, Data collections, Perth-Andover, Ontario, Truro, Nova Scotia, Canada.

Examination of ice jamming case histories and the limited technical information available on the subject indicate that there is a need to develop guidelines for including the effects of ice jams in flood risk mapping work and an even greater need to obtain reliable information on ice jam events. In the meantime, it is proposed that each location be considered separately to determine the best method of including the ice jamming aspects in flood risk mapping. (WATDOC)
W81-00475

HYDRAULIC ASPECTS OF ICE JAMMING,
Canada Centre for Inland Waters, Burlington (Ontario).
G. Tsang.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979, Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 211-227, 1980. 8 Fig, 1 Tab, 7 Ref.

Descriptors: *Ice jams, Frazil ice, Crystals, *Snowmelt, Equations, Mathematics, Models, Hydraulics, Flows, Shears, Stress, Roughness, *Flood damage, *Flood control, Canada.

The physical factors affecting ice formation and ice jamming are reviewed. Although it is possible to predict the occurrence of ice jamming with a certain degree of confidence, many problems remain unsolved including ice jam flooding characteristics, instability of ice cover, and the evolution of dynamic jams and their resistance to flow. (WATDOC)
W81-00476

2D. Evaporation and Transpiration

OXYGEN EXCHANGE BETWEEN A 'MODEL' POND AND THE ATMOSPHERE,
Science and Education Administration, Durant, Southern Plains Watershed and Water Quality Lab.
O. R. Lehman.
Advances in Water Resources, Vol 3, No 2, p 87-89, June, 1980. 2 Fig, 2 Tab, 15 Ref.

Descriptors: *Ponds, *Dissolved oxygen, *Air-water interfaces, Model studies, Atmosphere, Limnology, Water temperature, Winds, Rainfall, Precipitation, Weather, Air temperature, Environmental effects.

A glass-coated steel model pond 6 m in diameter and 2.5 m deep was placed in the ground under sheltered conditions to study oxygen exchange from April to December. The clean pond was filled with tap water, and disinfectant was added to control biological activity. Rain was the only uncontrolled water source. Oxygen exchange was calculated using daily dissolved oxygen measurements throughout the water column at 0800, 1300, and 1800 hr. Average oxygen exchange from April to December was 0.33 m/day. This level of exchange was in agreement with data reported for isolated surfaces in sheltered waters and in laboratory tanks, but was below values reported for large inland water bodies. The low oxygen exchange rate was attributed to a low average wind velocity (0.7 m/sec). It was suggested that the relationship of air and precipitation to water temperatures may be important in determining the rate of short-term oxygen exchange in sheltered waters. (Geiger-FRC)
W81-00495

2E. Streamflow and Runoff

PROCEEDINGS, 14TH ANNUAL MISSISSIPPI WATER RESOURCES CONFERENCE, 24-25 SEPTEMBER 1979,
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124430, Price codes: A06 in paper copy, A01 in microfiche. Conference held in Jackson, Mississippi '1979), 116 p. Water Resources Research Institute, Mississippi State University, Mississippi State. OWRT-A-999-MISS(15).

Descriptors: *Mississippi, *Conferences, *Tennessee-Tombigbee Waterway, Project planning, Environmental effects, Engineering structures, Regional economics, Dam failure, Flood damage, Erosion control, Sediment yield, Agriculture, Spillways, Mathematical studies.

Twenty of the twenty-one papers presented at the conference are given covering the areas of resource development, runoff and erosion, floods and flood plains, and water quality. Five of the papers center around the Tennessee-Tombigbee Waterway now under construction to provide a navigable waterway connecting the Tennessee River and the Gulf of Mexico. Other topics include dam safety, environmental impact assessment, streambank erosion, sediment yields, river crossings, crop damage assessment, remote monitoring systems, and water quality enhancement techniques. (See W81-00291 thru W81-00310) (Seigler-IPA)
W81-00290

STATISTICAL ANALYSIS OF STREAM EVENTS,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
V. L. Zitta, and B. A. Mowry.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 33-41, (1979) 13 Fig, 7 Ref.

Descriptors: *Statistical analysis, *Mississippi, *Flow characteristics, Flow profiles, Flow rates, Frequency analysis, Probability, Stochastic process, Synthetic hydrology, Mathematical studies, Distribution patterns, *Streamflow, Stream gages, Water measurement.

Long term records of daily stream flows in Mississippi were used to determine: (1) the monthly distribution of time between stream events; (2) the mean annual spans between events as related to drainage area; and (3) a probability density function applicable to the distribution of maximum annual span between events. Data used were on tape furnished by the U.S. Geological Survey. The tapes were searched for the longest period of record exhibiting stationarity, homogeneity, and consistency. The Pearl River Station at Edinburg was chosen for the analysis. Mean monthly spans and standard deviation for each month of the year were determined and related to drainage area. Frequency distributions were then determined for an annual series of maximum spans. The Kolmogorov-Smirnov test of goodness of fit was used and empirical plotting positions were based on Weibull's plotting position formula. From the distribution plots it is concluded that: (1) mean monthly spans are cyclic with maximums in October and February/March and minimums in December and July/August; (2) average spans between events tend to increase with increasing drainage area; and (3) a two parameter lognormal distribution was adequate to describe the distribution of maximum annual spans at the 0.80 significance level. (See also W81-00290) (Seigler-IPA)
W81-00298

QUICK ESTIMATION OF PARAMETERS OF MUSKINGUM METHOD OF FLOOD ROUTING,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
V. P. Singh, and R. C. McCann.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 65-69, (1979) 2 Fig, 2 Tab, 26 Ref.

Descriptors: *Muskingum method, *Flood routing, *River forecasting, Mathematical models, Least squares method, Optimization, Analytical techniques, Mathematical studies, Method of moments, Method of cumulants, Probability, Parametric hydrology, Estimating.

Five methods for determining Muskingum parameters are illustrated to evaluate the efficiency of each method. The method used are: (1) least squares, (2) method of moments, (3) method of cumulants, (4) graphical, and (5) direct optimization. The Muskingum method for routing flood waves in rivers and channels was developed in 1934. It is a spatially lumped form of a continuity equation and a linear storage-discharge relationship for a specified river reach. Its effectiveness de-

pends on the accuracy of parameters estimation which is typically done graphically. The results of an application example for the various methods of determining parameters suggest that there may be more than one set of parameters for the Muskingum method. Results are comparable indicating that the trial and error graphical method is no better than the other methods. The computations needed for the method of cumulants and moments, least squares method, and the direct optimization are small and can be easily performed with a small calculator. (See also W81-00290) (Seigler-IPA)
W81-00303

VARIATIONS OF A MISSISSIPPI RIVER CROSSING WITH STAGE,
Army Engineer District, Vicksburg, MS.
J. V. Hines.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 71-79, (1979) 11 Fig, 2 Tab.

Descriptors: *Mississippi River, *Crossings, *Channel morphology, Channel erosion, Scour, Thalweg, Sedimentation, Dredging, Water levels, Flood stages, Flood damage, Streamflow, River beds, Meanders, *Vicksburg(MS).

Changes in bed elevation of a crossing as affected by a flood hydrograph were studied at a well-defined crossing near Vicksburg, Mississippi. A crossing is that reach of river within which the thalweg shifts from one side of the channel to the other. Due to sedimentation from floods some crossings in the Mississippi have required dredging to reopen the channel depths needed for navigation. Data were collected by a Mini-Ranger III automatic positioning system which consists of a control unit with an omni-directional receiving antenna on a boat. Two transponders were located on the bank so that the entire survey area was under line-of-sight conditions. The survey area was divided into a series of 30 parallel track lines which provided for 3,700 data points per square mile. Computerized plots of data were prepared and data were stored by lines as a series of depths. Results show that for a well defined crossing the bed elevation will follow a pattern similar to that of the stage hydrograph. Volume variation shows that the upper end of the crossing is scouring at the beginning. As the stage rises the crossing moves upstream and as the stage crests, volume stabilizes, then slowly increases, dhowing a short lag before the bed begins to scour. Due to the many variables involved, the results of this study should not be freely applied to all crossings. (See also W81-00290) (Seigler-IPA)
W81-00304

EXPANDED FLOODPLAIN INFORMATION STUDY FOR THE WOLF RIVER BASIN, TENNESSEE AND MISSISSIPPI: A COMPUTER SIMULATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
T. L. Engdahl, and J. G. Collins.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 81-85, (1979) 4 Fig, 3 Ref.

Descriptors: *Mississippi, *Simulation analysis, *Computer moels, Computer programs, Data processing, Flood forecasting, Hydrograph analysis, Watersheds(Basins), Hydrology, Flood profiles, Flood plains, Flood data, Flow characteristics, *Wolf River basin(MS-TN).

A simulation system was developed for the Wolf River basin to be used as a planning tool to forecast the impacts of land use, channel modifications, and the addition of hydraulic structures. The Wolf River basin is approximately 65 miles in length, ranges from 10 to 15 miles in width, and has an area of 817 square miles. There are more than 400 miles of stream channels within the basin. Data on channel and overbank roghness, precipitation, gaging, cross-sections, and other areal characteristics were obtained from various agencies. The 'Flood Hydrograph Package', HEC-1, was used to compute, route, and combine hydrographs. Forty-seven subbasins were divided into minibasins for runoff computations. A grid system of subdivisions was also used. Three data bases were used for hydrologic and hydraulic analyses. Three major supporting programs were developed in addition to the software routines for the data bases. A program written to access the cross-section file can output an input deck for a subbasin including tributaries. A program, FLOOD, accesses the water elevation files. The system developed can be easily modified for updating and research and the methodologies developed are generally applicable to any basin. A flow chart of the hydrologic-hydraulic simulation process is include. (See also W81-00290) (Seigler-IPA)
W81-00305

COMPUTERIZED AGRICULTURAL CROP FLOOD DAMAGE ASSESSMENT SYSTEM,
Army Engineer District, Vicksburg, MS.
W. B. Hobgood, and T. C. Hill.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 87-88, (1979).

Descriptors: *Flood damage, *Agriculture, *Computer programs, Crop production, Hay, Wheat, Soybeans, Pastures, Flood data, Regional flood, Assessments, Evaluation, Flood stages, Computer models.

CACFDAS, the Computerized Agricultural Crop Flood Damage Assessment System, uses historical data on a daily basis, current budget data, present cropping patterns and production techniques, and other data to evaluate flood damages. CACFDAS analyzes the effects of physical factors such as depth, duration, and seasons of flooding on crop specific flood damages. The input system consists of the following: initial reach crop distribution data, expected net and gross for each crop, alternative substitution crop data, last date of replanting data, computerized crop budget data, itemized cultural or operation practices, and digitized stage-area data. Digitized data is read until a flood is defined. Floods are divided into minifloods or bands of inundation to account for differential dryout periods. Crops are classified as spring crops, winter crops, pasture, hay, and wheat-soybean double crop. Damages are calculated on area flooded, duration, and initial crop distribution. Three output formats are available: (1) brief, reports damages per flood year and summarizes each reach; (2) normal, reports damages for each flood, for each year, for each reach; and (3) debug, reports damages for each year, for each reach, with debugging down to the 'band' level. (See also W81-00290) (Seigler-IPA)
W81-00306

CHANNEL AND DYNAMIC FLOW CHARACTERISTICS OF THE CHATTAHOOCHEE RIVER, BUFORD DAM TO GEORGIA HIGHWAY 141,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 8B.
W81-00362

WINTER WATER--THE FLOODING AT BOISE, IDAHO, JANUARY 11-12, 1979,
Geological Survey, Boise, ID. Water Resources Div.
R. W. Harper, and E. F. Hubbard.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225, paper copy, $3.50, microfiche $0.50. Geological Survey Open-File Report 80-201 (WRI), 1980. 1 Sheet, 5 Fig, 1 Tab, 2 Ref.

Descriptors: *Flooding, *Idaho, *Rainfall, *Snowmelt, *Storm runoff, Air temperature, Thawing, Streams, Flood stages, Peak discharge, Indirect flood measurement, Flood damage, Water quality, Flood protection, Planning, Flood forecasting, Boise(ID).

On January 11 and 12, 1979, unseasonally warm temperatures and rain on several inches of snow lying on frozen ground caused widespread flooding in and around Boise, Idaho. Streams north of Boise crested on January 11, flooding neighborhoods in and adjacent to the mountain foothills. On January 12, streams south and west of the city reached their highest stages. Flooding was confined to ground levels and basements of homes and businesses in low-lying areas. The U.S. Geological Survey made indirect measurements of peak discharges at selected sites on streams that had the worst flooding. The peak discharges were relatively low in comparison with data from historic floods. Much more severe flooding than this event is likely to occur in the future. More data are needed on the occurrence of flooding in Boise Valley to aid in flood-protection planning. (USGS)
W81-00364

REPORT ON WORKING GROUP NO. 1. OPEN CHANNEL HYDRAULIC MODELLING,
National Water Research Inst., Burlington (Ontario).
T. M. Dick.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop, Series No 2, p 8-12, 1980.

Descriptors: *Hydraulic models, Analytical techniques, *Flood damage, Flood control, *Management, Research and development, Performance, *Open channel flow, Canada.

The choice of models for flood level prediction is limited. Of primary concern is the reliability of the calculations which are translated eventually into action to reduce flood damage. Computational problems and routines are the main concern of modellers, but management is more concerned with the result. There should be greater priority given to establishing the reliability and accuracy of models; thus more research and development activity, especially to verify statistically the performance of models, is probably needed. (WATDOC)
W81-00465

REPORT ON WORKING GROUP NO. 2. HYDROLOGIC MODELLING,
National Hydrology Research Inst., Ottawa (Ontario).
F. I. Morton, and W. Nemanishen.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 13-18, 1980. 2 Tab.

Descriptors: *Hydrologic models, Research and development, *Runoff, Workshop, Technology transfer, *Flood damage, *Flood control, Canada.

Participants were requested to address themselves to three of the workshop objectives. There were: (A) Identification of gaps in knowledge requiring research, (B) Identification of related technical questions requiring further study and/or detailed information transfer, (C) Identification of improved methods for effecting technological transfer. (WATDOC)
W81-00466

REPORT ON WORKING GROUP NO. 3. STOCHASTIC ANALYSIS AND OPERATIONAL RESEARCH,
Inland Waters Directorate, Ottawa (Ontario).
R. L. Pentland.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 19-22, 1980. 3 Tab.

Descriptors: *Flood frequency analysis, Findings, Research requirements, *Flood damage, *Flood control, Canada.

The working group discussed four broad categories: frequency analysis at gauged sites; ungauged sites and regional analysis; large lake/coastal situa-

tions and reservoir operation; and physical interventions. For each of these, the group identified findings and research needs which attempted to address, respectively, findings of general value to operational people in the flood damage reduction program, and links which should be made between the program and research-programs. The findings and conclusions are summarized. A summary is provided of more general conclusions reached by the group which are considered important to the FDR program but which could not be classified along with the more specific conclusions. Also included, for general information, is a survey of the numbers of agencies using various frequency analysis techniques. (WATDOC)
W81-00467

SIMPAK FOR RIVER BASIN STUDIES,
Inland Waters Directorate, Vancouver (British Columbia).
J. C. Y. Lee, and R. O. Lyons.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada. Technical Workshop Series No 2, p 93-109, 1980. 6 Fig.

Descriptors: *Streamflow routing, Diversion, *Flood forecasting, *River modelling, Simulation, Flow nets, Hydrologic SIMPAK program, SSARR, *Flood control, Fraser River, Columbia River, Mackenzie River, Research and development, Canada.

In several studies in the Pacific and Yukon Region, streamflow routing models have been used to determine the downstream effects of various reservoir or diversion projects. In the earlier studies, the SSARR Program was adopted as one of the vehicles for routing studies in the region. However, only a fraction of the capabilities of SSARR were required for this task. The desired result could be achieved by simply using the routing methods of the SSARR Program and building a separate program framework to do all the data handling. Thus, the simulation package (SIMPAK) for river modelling was developed and used by the Vancouver Office of Inland Waters Directorate for several river basin studies. It has been used to perform river routing and reservoir regulation, critical flood flow forecasting and other operations involving manipulation of streamflow data. The critical flood flow forecasting was developed specifically for day-to-day reservoir flood control operation. The technique derived for the forecasts is a simplified approach yet provides a workable and useful tool for reservoir operation. This paper describes the features of the program, provides a comparison with the SSARR model, and describes some applications. (WATDOC)
W81-00468

DEVELOPMENT OF A REAL-TIME OPERATIONAL MODEL FOR THE OTTAWA RIVER - A PROGRESS REPORT,
Inland Waters Directorate, Ottawa (Ontario).
G. A. Nix.
In: Proceedings of the Technology Transfer, Workshop Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada. Technical Workshop Series No 2, p 110-130, 1980. 6 Fig.

Descriptors: *Flood control, *Flood forecasting, *Model studies, Warning systems, River regulation, Ottawa River, Forecasting reservoir operation, Peak discharge, Hydrologic data, Development, Testing, Input data, Output format, Canada.

In May, 1974, a Canada-Quebec agreement was signed that initiated studies on flooding and low water problems in the Montreal region, the study report recognized that any potential for reducing flooding in the Montreal region lay in optimizing the operation of the many reservoirs in the Ottawa River basin. As a result of the recommendations in the report, the Ottawa River Regulation Planning Committee was formed in February, 1977. The Committee formed a subcommittee to recommend criteria for regulation of the Ottawa River, taking into account hydro power production, flood protection, navigation, low water problems, water quality needs and recreation. A working group was then formed to develop a mathematical model for the regulation of the Ottawa River. This report describes the progress towards the development of the model. (WATDOC)
W81-00469

HEC-2 APPLICATION AT MOOSE JAW - INPUT REQUIREMENTS AND MODEL PERFORMANCE,
Inland Waters Directorate, Regina (Saskatchewan).
R. D. Hofer.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada. Technical Workshop Series No 2, p 131-140, 1980. 2 Fig, 2 Ref.

Descriptors: *Flood control, Hydrographs, *Floodways, *Streamflow forecasting, Hydraulics, *Model studies, Hydrologic data, Reservoir operation, Flood frequency, Model performance, Peek discharge, Maximum probable floods, Moose Jaw River, Canada.

On March 8, 1978, IWD, Western and Northern region, entered into an agreement with the Saskatchewan Department of the Environment to conduct various hydraulic investigations under the Canada-Saskatchewan flood damage reduction agreement. The initial contract called for the development of 1:100 and 1:500 floodlines along the Moose Jaw River, Thunder Creek and Spring Creek. A floodway along the Moose Jaw River was also called for. The Hec-2 model was acquired for this project to carry out the streamflow modelling. This paper describes the procedures used, the modelling problems, and the results. (WATDOC)
W81-00470

MATHEMATICAL MODELLING OF THE FRASER RIVER SYSTEM,
Inland Waters Directorate, Ottawa (Ontario).
M. Sydor, and P. Zrymiak.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada. Technical Workshop Series No 2, p 141-145, 1980.

Descriptors: *Flood control, *Flood damage, *Mathematical models, *Dynamic programming, Water discharges, Sediment data, Input-output analysis, Fraser River, Canada.

A one dimensional finite difference hydrodynamic model has been applied to the complex channel system of the lower Fraser River. The input data was a set of approximately 700 cross sections collected by the Department of Public Works in 1962 and 1976. Initial success using the model was realized by calibrating to a discharge of 350,900 CFS discharge on July 12, 1976, and by simulating the June 4, 1976 river condition when 227,500 CFS was recorded. With such encouraging results, the studies are continuing and various periods are to be studied in order to determine the range of accuracy possible in using this model. (WATDOC)
W81-00471

APPLICATION OF THE DWOPER MODEL TO THE LOWER SAINT JOHN RIVER,
MacLaren (James F.), Willowdale (Ontario).
H. S. Belore, A. K. Bhattacharyya, and C. T. Bishop.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 146-162, 1980. 4 Fig, 2 Tab, 19 Ref.

Descriptors: *Flood routing, *Model studies, Flow, Hydraulics, *Flood profiles, Hydrologic data, *Flood control, Physical data, Numerical analysis, Recurrence intervals, Data base systems schematization, Mathematics, Simulation analysis, Hydrograph analysis, *Flood forecasting, Saint John River, Canada.

An unsteady flood routing model, referred to as DWOPER (Dynamic Wave Operational model), has been applied along the lower Saint John River. The model, which is representative of the state of the art in unsteady flow modelling, was selected for this application after considering a number of available hydraulic routing techniques. The model accounts for factors such as the downstream effects of the reversing falls and flow over the Trans Canada Highway to large storage areas in the Grand Lake area. Model calibration and verification simulations resulted in a good reproduction of historical flood levels. Subsequently, flood profiles associated with the 1:20 and 1:100 year recurrence interval flood events were determined along the lower Saint John River from McKinley Ferry to Lower Jemseg. (WATDOC)
W81-00472

APPLICATION OF FINITE ELEMENT METHOD IN RIVER NETWORK HYDRAULICS,
Inland Waters Directorate, Burlington (Ontario).
S. M. A. Moin.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada. Technical Workshop Series No 2, p 163-178, 1980. 8 Fig, 2 Tab, 21 Ref.

Descriptors: *Finite element analysis, Analytical techniques, Mathematics, Flow, Hydraulics, *Numerical analysis, Equations, St. Lawrence River, Parametric hydrology, Open-channel networks, *Flood damage, *Flood control, Canada.

This paper describes a finite element model of the unsteady flow regime in open channel networks. Mathematically, one dimensional unsteady flow hydraulics of open channels is described by a pair of nonlinear, partial differential equations of hyperbolic type and is solved by adopting linear elements. A predictor-corrector method for solving the nonlinear equation is utilized. Simulation capabilities of the computerized model were investigated in determining the steady state profile for the St. Lawrence River. Limited scale sensitivity analysis was conducted to study the influence of the variation of the weighting parameter. A comparison of the model output with the observed events and/or calculated values indicates the suitability of the model from the viewpoints of simulation capabilities, adoption of higher time steps, conservation of mass, flexibility of operations, and handling of complex network configurations. (WATDOC)
W81-00473

MATHEMATICAL MODELLING OF UNSTEADY FLOWS IN MOBILE BOUNDARY CHANNELS,
Canada Centre for Linland Waters, Burlington (Ontario).
B. G. Krishnappan.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada. Technical Workshop Series No 2, p 179-197, 1980. 10 Fig, 9 Ref.

Descriptors: *Mathematical models, *Numerical analysis, *Flood control, *Flood forecasting, Unsteady flow, Equations, Sediments, Flood waves, Testing, Water levels, Hydraulics, Bed levels, Model predictions, Detroit River, Rio Vista, California.

A numerical model is described which solves the unsteady flow equations for a mobile boundary channel. This model is capable of predicting the floodwave characteristics as well as the environmental impacts of man's activities in river basins. The model was verified under laboratory conditions, and a reasonably good agreement between

the model predictions and laboratory measurements was observed. (WATDOC)
W81-00474

ICE JAMMING CONCERNS AND OPERATIONAL SOLUTIONS,
Inland Waters Directorate, Halifax (Nova Scotia).
For primary bibliographic entry see Field 2C.
W81-00475

HYDRAULIC ASPECTS OF ICE JAMMING,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2C.
W81-00476

METEOROLOGICAL INPUTS FOR HYDROLOGICAL MODELS,
Atmospheric Environment Service, Toronto (Ontario). Science Service Div.
R. G. Lawford.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reductions, Hull, Quebec, May 23-25, 1979, Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 231-244, 1980. 1 Fig, 9 Ref, 1 Append.

Descriptors: *Hydrologic models, *Meteorology, *Flood forecasting, *Warning systems, *Flood control, Networks, Precipitation, Temperature, Weather radar, Satellites, Canada.

Precipitation and temperature are the principal controls of the hydrologic cycle. Historical and real time data are available from Atmospheric Environment Service, and forecasts of precipitation and temperature are available from regional weather centres and from the Canadian meteorological centre. New technologies and their application to hydrologic models are discussed and a brief outline of changes that could be made to the models are suggested to provide more realistic representations of the meteorological processes. Recommendations are made for further improvement of hydrological models and their application to a flood-damage warning system. (WATDOC)
W81-00477

THE NEED FOR A REGIONAL UNIT HYDROGRAPH ANALYSIS OF ONTARIO,
Water Survey of Canada, Ottawa (Ontario).
D. Kimmett.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 245-264, 1980. 5 Fig.

Descriptors: *Hydrograph analysis, *Flood forecasting, Water resources, Unit hydrographs, Model studies, Conservation authorities, *Flood damage, *Flood control, Canada.

Many of the credibility problems associated with past hydrologic studies are related to the fact that each individual has a different understanding of unit hydrograph theory and how it is best applied. It is proposed that Water Survey of Canada develop the necessary in-house expertise and publish unit hydrograph(s) on a continuing as required basis for appropriate hydrometric stations. Recent technological advancements, the need for standards in hydrology generally, and the availability of sufficient data are further incentives for initiating such a program at this time. An informal canvass of several data users drew favorable responses to the concept. A conceptual look at what should be published is provided. (WATDOC)
W81-00478

RUNOFF FROM DEVELOPING AREAS,
Canada Centre for Inland Waters, Burlington (Ontario).
J. Marsalek.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical workshop Series No 2, p 265-276, 1980. 1 Fig, 1 Tab, 14 Ref.

Descriptors: *Hydrologic models, *Runoff, *Floods, Rainfall, Hydrology, *Watersheds(Basins), *Flood control, *Hydrometeorology, Infiltration, Flood damage, Water loss, Simulation analysis, Calibration - Varification data, Canada.

Runoff from developing areas is of particular interest in connection with flood modelling because the land development dramatically alters the watershed hydrological response. During the past 15 years, a number of models for modelling of runoff from development and refinement of these models is currently underway with particular reference to the assessment of the effects of urbanization on the watershed hydrological regimen, modelling of infiltration, and modelling of flood damages. (WATDOC)
W81-00479

FLOOD FORECASTING IN THE SAINT JOHN RIVER BASIN - MATHEMATICAL MODELLING ACTIVITIES,
Inland Waters Directorate, Halifax (Nova Scotia).
D. A. Smith.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada. Technical Workshop Series No 2, p 277-311, 1980. 5 Fig, 1 Tab, 11 Ref.

Descriptors: *Flood forecasting, *Mathematical models, *Snowmelt, *Streamflows, Hydrologic data, Meteorology, Synthesis, River routing, Flood damage, Saint John River, Canada.

The development of a flood forecasting system for the portion of the Saint John River basin in the province of New Brunswick is reviewed. The paper progresses, in chronological order, from the time when there was no forecasting system, through the first efforts to calibrate the SSARR model for the basin and the forecasting operations during the 1973 record historic flood to the present. Emphasis is placed on the mathematical modelling activities and on recent efforts to improve the forecasting system being carried out under the Canada - New Brunswick flood damage reduction program. The major concerns of the technical subcommittee for flood forecasting are presented, and the activities presently underway, or planned, to overcome some of these difficulties are discussed. (WATDOC)
W81-00480

DATA NETWORK DESIGN FOR WATERSHED FORECASTING,
Inland Waters Directorate, Halifax (Nova Scotia).
D. C. Ambler.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 312-319, 1980. 1 Fig, 6 Ref.

Descriptors: *Network design, *Hydrologic data, *Flood forecasting, Saint John River, Mathematical models, Gaging, Climatic data, *Flood control, Canada.

The paper describes the data network required to support a flood forecasting operation with particular reference to the Saint John River. Sources of error in stream gauge measurements and their influence on the hydrologic model output and forecasting are discussed. (WATDOC)
W81-00481

OTTAWA RIVER - COMPARISON OF THE HYDRO QUEBEC AND SSARR MODELS,
Inland Waters Directorate, Ottawa (Ontario).
G. E. Brown.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 320-330, 1980. 2 Tab.

Descriptors: *Flood forecasting, *Flood control, *Hydrometric models, *Watersheds(Basins), Mathematics, Equations, Streamflow discharges, Snowmelt, Model calibration, Performance, Canada.

An analysis of the forecasted watershed and streamflow discharge results for five Ottawa River basin watersheds was undertaken to compare the Hydro Quebec and SSARR natural inflow models. The Hydro Quebec model generally out-performed the SSARR model for these five particular watersheds. With respect to 10 day forecast results there was a noticeable deterioration in the SSARR model results, whereas the Hydro Quebec model showed a marginal deterioration from each day to the next of the forecast period. It is pointed out that the Hydro Quebec model was designed for relatively large watersheds calibrated to moving 7 day mean daily inflows for reservoirs at the extremity of each basin. Thus, performance of the Hydro Quebec model is uncertain for hydrometrically gauged watersheds, since the five watersheds in question were calibrated to computed reservoir inflow data. (WATDOC)
W81-00482

SHORT-TERM AND LONG-TERM HYDROMETEOROLOGICAL EPOCHS,
Inland Waters Directorate, Calgary (Alberta).
W. Nemanishan.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 331-341, 1980. 10 Fig, 17 Ref.

Descriptors: *Flood forecasting, Runoff, Model studies, *Hydrometeorology, Sea surface, Temperatures, *Flood control, Droughts, South Saskatchewan River, Equations, Hydrology, Streamflow, Canada.

Scientific evidence is becoming stronger to indicate that extraterrestrial factors, such as solar activity and lunar cycles, influence atmospheric and oceanic circulation which then combine to produce prolonged droughts or floods in specific locations of the northern hemisphere. The studies of several prominent world scientists are highlighted to show how their findings can be used to improve Inland Waters Directorate studies of western Canadian flood problems. A case history is presented to illustrate the difficulty of assigning correct return periods for rare flood events and the valuable contribution that runoff modelling can make in these cases. (WATDOC)
W81-00483

THE THREE PARAMETER LOGNORMAL DISTRIBUTION APPLIED TO REGIONAL FLOOD FREQUENCY ANALYSIS BY THE INDEX FLOOD METHOD,
Inland Waters Directorate, Ottawa (Ontario).
R. Condie.
In: Proceedings of the Technology Transfer Workshop, Modelling Activties Related to Flood Damage Reduction, Hull, Quebec, May 13-25, 1979, Inland Waters Directorate, Ottawa, Ontario, Canada. Technical Workshop Series No 2, p 345-353, 1980. 3 Tab, 4 Ref.

Descriptors: *Flood frequency, Maximum probable floods, Homogeneity tests, Regression analysis, Equations, Parametric hydrology, Annual flood, Regionalization, Canada.

Regional flood frequency analysis by the index flood method is in fairly common use when estimates of flood flows of specific probabilities are required at ungauged river sites. Use of this method usually assumes that the Gumbel 1 distribution gives a fair representation of the flood frequency regime throughout a homogeneous region, and the most commonly used homogeneity test is

based on sampling from that distribution. Some reservations have arisen regarding the adequacy of the Gumbel 1 distribution, but use of other distributions may have been inhabited by lack of appropriate homogeneity tests. The three parameter log-normal distribution is generally superior to the Gumbel 1 in Canada. Reasons for this choice are given and the derivation of a homogeneity test is described. Advantages and disadvantages of the index flood method are also discussed in relation to the method of direction regression on the T-year flood. (WATDOC)
W81-00484

FLOOD FREQUENCIES BY THE KINEMATIC WAVE MODEL,
Inland Waters Directorate, Vancouver (British Columbia).
R. O. Lyons.
In: Proceedings of the Technology Transfer. Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 354-368, 1980. 1 Tab, 7 Ref.

Descriptors: *Flood frequency, *Design flood, *Mathematicl models, Mathematics, *Equations, Probability, Peak discharge, Rainfall intensity, Computation, Parametric hydrology, Runoff, Meteorology, Topography, Canada.

The kinematic wave model was used by Inland Waters Directorate, Pacific and Yukon Region, as one of several methods to estimate design floods for the Alaska Highway Pipeline Investigation. This paper briefly describes the basic equations forming the model and discusses the way the model was caglibrated for the southern Yukon. The model gives a convenient method for directly estimating flood frequencies at ungauged basins. A fairly large effort in analysis of meteorological data is required, but once this is done, frequency curves can be developed quickly, cheaply, and directly. (WATDOC)
W81-00485

FLOOD FREQUENCY ANALYSIS BY POWER TRANSFORMATION,
Water Survey of Canada, Vancouver (British Columbia).
R. S. McAully.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 369-382, 1980. 1 Fig, 5 Tab.

Descriptors: *Flood frequency, *Computer programs, Power transformation method, Peak discharge, Streams, Ash River, *Model studies, Equations, Canada.

This paper describes a technique for flood frequency analysis by fitting the normal probability distribution to an annual flood series after applying what has been called a power transformation. The computer program to implement this power transformation is described and some results from analyzing 35 streams in British Columbia are presented. The power transformation method, which is very easy to apply, generally gave excellent agreement with the established log-Pearson III method. (WATDOC)
W81-00486

FLOOD FREQUENCY ANALYSIS CONCERNS IN THE ATLANTIC REGION,
Inland Waters Directorate, Halifax (Nova Scotia).
J. D. Keefe.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 383-409, 1980. 4 Fig, 2 Tab, 6 Ref.

Descriptors: *Flood frequency, *Flood forecasting, Floods, Data base, *Parameteric hydrology, Flood risk mapping program, Atlantic Canada, Flood recurrence interval, Peak discharge, Saint John River, Mathematical model, Regional floods, Canada.

This paper highlights some of the technical problems being experienced in the Atlantic region in implementing the flood risk mapping program, the approaches to overcome these problems, and the areas in which more applied research and development and/or further guidelines are required. The discussion is supported by examples from various existing or planned investigations where available. (WATDOC)
W81-00487

A FLEXIBLE FAMILY OF STACHASTIC MODELS,
Waterloo Univ. (Ontario). Dept. of System Design.
K. W. Hipel.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979, Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 422-431, 1980. 1 Tab, 18 Ref.

Descriptors: *Stochastic processes, *Flood forecasting, *Statistical models, *Synthetic hydrology, Time series analysis, Mathematics, Intervention analysis, River flow data, Spring runoff, Forest fire model, Canada.

The family of Box-Jenkins models, and other closely related stochastic models, form a group which can be used to help solve many types of problems which arise in hydrology. A model which is of particular importance in hydrology is the intervention model. This model can be employed to determine the effects of man induced or natural interventions upon the mean level of a time series, to fill in missing observations in a time series, and to answer other kinds of similar problems. Following a description of the intervention model, it is explained how the most appropriate type of intervention model can be selected to fit to a specific data set by adhering to the identification, estimation, and diagnostic check stages of model development. A number of examples confirm the importance of this model for modelling Canadian hydrological data. (WATDOC)
W81-00488

HYDROLOGIC EXTREME VALUE MODEL AND RISK ANALYSIS APPLIED TO FLOOD PLAIN MANAGEMENT,
Ecole Polytechnique, Montreal (Quebec). Dept. of Civil Engineering.
F. Ashkar, N. El-Jabi, and J. Rouselle.
In: Proceedings of the Technology Transfer Workshop, Modelling Activitis Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 432-446, 1980. 5 Fig, 5 Ref.

Descriptors: *Flood plains, *Flood plain insurance, *Zoning, Protection, Control, Mathematical models, Stachastic processes, Time series analysis, Statistical methods, Parametric hydrology, Equations, Canada.

Rational planning of flood plains may be undertaken by separating them into different zones to control their development, and basing insurance premiums on flood damage risk for each zone. The risk may be established from the relationship between the return period, or the occurrence of a given flood, and the flood level. A mathematical model based on the extreme values theory in stachastic processes has been established where the distribution function of these maximum exceedances in an interval of time (O,t) could be found. Bayesian and maximum likelihood approaches are followed in order to find the distribution function of the exceedance for a given return period when uncertainty arises in the parameters of the distribution function describing the model. The risks encountered in evaluating this exceedance using different lengths of period of record are compared. (WATDOC)
W81-00489

HYDRO CONFIGURATION MODELLING SYSTEM,
Inland Waters Directorate, Ottawa (Ontario).
D. W. Farley.
In: Proceedings of the Technology Transfer Workshop, Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 447-455, 1980. 2 Fig, 5 Ref.

Descriptors: *Model studies, *Flood control, *Linear programming, *Time series analysis, Stochastic processes, Synthetic hydrology, Dynamic programming, Reservoir operation, Mathematics, Continuity equations, Canada.

A generalized modelling package referred to as HCMS (hydro Co-figuration Modelling System) has been developed for studying multi-reservoir river systems. The package is particularly applicable to basins in which there is an existing hydroelectric generating capacity and/or a potential for further development. The package is used to evaluate proposals relating to: increased reservoir storage devoted to flood protection; new reservoirs; new installed turbine capacity; environmental requirements in terms of constrained reservoir levels or minimum flows; diversions of flow; and increased channel discharge capacity. By comparing the results of different simulated operation policies and configurations with each other and with historical performance, the planning team can readily assess the impact on flood protection, energy production, and environmental concerns. In order to expedite the modelling phase of studies, the package is endowed with a realistic optimal seeking solution routine. This optimal seeking solution routine employs a linear programming sub-routine, available from the IBM package SL-Math. As opposed to other applications of linear programming to water resource systems studies, the optimal seeking solution routine of this model does not assume perfect hindsight of time series data, nor is it restricted to critical periods of record to conform with dimensionality requirements common to other optimization models. (WATDOC)
W81-00490

A PROCEDURE FOR DETERMINING FLOOD FREQUENCIES FOR GREAT LAKES SHORELIN E,
Inland Waters Directorate, Burlington (Ontario).
D. W. Brown, R. J. Moulton, and S. M. A. Moin.
In: Proceedings of the Technology Transfer Workshop Modelling Activities Related to Flood Damage Reduction, Hull, Quebec, May 23-25, 1979. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 2, p 456-465, 1980. 2 Fig, 4 Ref.

Descriptors: *Flood frequency, *Flood forecasting, *Model studies, Flood control, Climatology, Peak discharge, Winds, Waves, Mathematical studies, Equations.

Procedures are presented which can be used to determine flood frequencies on the Great Lakes. The procedure varies according to the availability of data. The procedure is relatively simple near gauges where there are records of peak flood levels. If such data is not available, the procedure becomes more complex, as the flood frequencies must be derived by calculating wind set-up and run-up distributions from climatologic data and combining these frequency distributions with mean water level frequency distribution for the lake. (WATDOC)
W81-00491

2F. Groundwater

INVESTIGATION OF A SURFACE RESISTIVITY TECHNIQUE FOR THE ESTIMATION OF HYDRAULIC CONDUCTIVITY IN STRATIFIED DRIFT AQUIFERS,
Connecticut Univ., Storrs. Dept. of Geology and

Geophysics.
For primary bibliographic entry see Field 8B.
W81-00267

STRATIFIED BIDIRECTIONAL SEEPAGE FLOW THROUGH AN EARTHEN EMBANKMENT,
Lowe (Roger) Associates, Inc., Bellevue, WA.
For primary bibliographic entry see Field 2H.
W81-00270

AREAS OF NATURAL RECHARGE TO THE FLORIDAN AQUIFER IN FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-00345

WATER LEVELS IN ARTESIAN AND NONARTESIAN AQUIFERS OF FLORIDA, 1977-78,
Geological Survey, Tallahasses, FL. Water Resources Div.
H. G. Healy.
Denver, CO. 80225. Paper copy $13.50, microfiche $3.50. Geological Survey Open-File Report 80-693, 1980. 99 p, 54 Fig, 1 Tab, 10 Ref.

Descriptors: *Groundwater resources, *Water levels, *Florida, *Aquifer characteristics, *Drawdown, Pumping, Observation wells, Groundwater recharge, Water level fluctuations, Hydrographs.

During 1977 and 1978, water levels in the Floridan aquifer throughout most of north and central peninsular Florida rose 1 to 3 feet, based on water levels measured in 380 wells selected from a network of about 5,000 observation wells for which measurements are in the files of the U.S. Geological Survey. Hydrographs of 51 wells are presented which show long-term trends of ground-water levels in selected areas of Florida. In west-central Polk County, an area of notable pumping, levels in the Floridan and other aquifers rose in response to decreased pumping of ground water for industrial use. In north Florida, levels rose from 1 to about 4 feet in Suwannee and Hamilton Counties. In northwest Florida, levels in the sand-and-gravel aquifer rose from less than 1 foot to 5 feet. Most widespread declines in ground-water levels in northwest Florida occurred in the Tallahassee area where levels declined from 1 to nearly 5 feet. (USGS)
W81-00346

THE SURFICIAL AQUIFER AT THE U.S. NAVAL STATION NEAR MAYPORT, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
B. J. Franks.
Denver, CO. 80225. Paper copy $2.00, microfiche $3.50. Geological Survey Open-File Report 80-765, 1980. 13 p, 3 Fig, 2 Tab, 8 Ref.

Descriptors: *Unconsolidated aquifers, *Aquifer characteristics, *Groundwater, *Water quality, *Shallow wells, *Florida, Potential water supply, Water table, Water wells, Test wells, Brackish water, Transmissivity, Water yield, Water utilization, Water chemistry, Heat exchangers, Hydrogeology, Evaluation, *Duval County(FL).

The surficial aquifer at the U.S. Naval Station near Mayport, Florida, consists of about 70 feet of unconsolidated sand, shell, and clay. The principal water-bearing zone is a shell bed 35 to 55 feet below land surface. The aquifer is unconfined, and the water table was about 4 feet below land surface during the investigation (spring 1979). Aquifer tests indicate a transmissivity for the aquifer of approximately 2,400 feet squared per day. Water in the upper 40 feet of the aquifer is fresh, but becomes increasingly brackish with depth. Use of water from the surficial aquifer is limited because of low yields and poor water quality. Feasibility of injection of return cooling water into the surficial aquifer is limited by the shallow water table. (USGS)
W81-00349

POTENTIOMETRIC MAP OF THE COFFEE SAND AQUIFER IN NORTHEASTERN MISSISSIPPI, OCTOBER AND NOVEMBER 1978,
Geological Survey, Jackson, MS. Water Resources Div.
B. E. Wasson.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO. 80225, Paper copy $2.50, microfiche $0.50. Geological Survey Open-File Report 79-1587 (WRI), 1980. 1 Sheet, 7 Ref.

Descriptors: *Maps, *Potentiometric level, *Aquifers, *Groundwater, *Mississippi, Water resources, Natural recharge, Observation wells, Water level fluctuations, Hydrogeology, Hydrographs, *Coffee Sand aquifer(MS).

This potentiometric map of the Coffee Sand aquifer in northeastern Mississippi is the fourth in a series of maps, prepared by the U.S. Geological Survey in cooperation with the Mississippi Department of Natural Resources, Bureau of Land and Water Resources, delineating the potentiometric surfaces of the major aquifers in Mississippi. In the outcrop areas the potentiometric surface is strongly affected by recharge from precipitation, topography, and drainage of the aquifer by streams. The potentiometric surface slopes generally to the west away from the area of outcrop and is mildly affected by moderate ground-water withdrawals by wells in Tippah and Union County. Historically, water levels in or near the outcrop of the Coffee Sand have shown little or no long-term changes as shown by a hydrograph of one well in Alcorn County. In the downdip part of the aquifer water-level declines of 2 feet per year are common. (USGS)
W81-00356

POTENTIOMETRIC MAP OF THE EUTAW-MC SHAN AQUIFER IN NORTHEASTERN MISSISSIPPI, SEPTEMBER, OCTOBER, AND NOVEMBER 1978,
Geological Survey, Jackson, MS. Water Resources Div.
B. E. Wasson.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO. 80225. Paper copy $2.50, microfiche $0.50. Geological Survey Open-File Repot 79-1584 (WRI), 1980. 1 Sheet, 9 Ref.

Descriptors: *Maps, *Potentiometric level, *Aquifers, *Groundwater, *Mississippi, Water resources, Natural recharge, Observation wells, Water level fluctuations, Hydrogeology, Hydrographs, *Eutah-McShan aquifer(MS).

This potentiometric map of the Eutaw-McShan aquifer in northeastern Mississippi is the third in a series of maps, prepared by the U.S. Geological Survey in cooperation with the Mississippi Department of Natural Resources, Bureau of Land and Water Resources, delineating the potentiometric surfaces of the major aquifers in Mississippi. From its outcrop area the Eutaw-McShan aquifer dips about 30 feet per mile to the west and southwest. Thickness of the aquifer commonly is between 200 and 300 feet in most of the area, and commonly about one-half this thickness consists of sand. In the outcrop area the potentiometric surface is strongly affected by recharge from precipitation, topography, and drainage of the aquifer by streams. The potentiometric surface of the aquifer slopes generally to the west away from the area of outcrop and it is strongly affected by large ground-water withdrawals at or near Tupelo, Aberdeen, and West Point. Historically, water levels in or near the outcrop of the Eutaw-McShan aquifer have shown little or no long-term changes. Withdrawals of water by wells from the downdip area have caused long-term water-level declines of 1 to 2 feet per year in much of the confined part of the aquifer. Water-level declines during recent years in several observation wells in Lee County ranged from 2 to 9 feet per year. One hydrograph in Clay County that is near the center of the depression in the potentiometric surface at West Point shows about 5 feet per year of water-level decline since 1972. (USGS)
W81-00357

POTENTIOMETRIC MAP OF THE RIPLEY AQUIFER IN NORTHEASTERN MISSISSIPPI, OCTOBER AND NOVEMBER 1978,
Geological Survey, Jackson, MS. Water Resources Div.
B. E. Wasson.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO. 80225, Paper copy $2.50, microfiche $0.50. Geological Survey Open-File Report 79-1585 (WRI), 1980. 1 Sheet, 5 Ref.

Descriptors: *Maps, *Potentiometric level, *Aquifers, *Groundwater, *Mississippi, Water resources, Natural recharge, Observation wells, Water level fluctuations, Hydrogeology, Hydrographs, *Ripley aquifer(MS).

This potentiometric map of the Ripley aquifer in northeastern Mississippi is the fifth in a series of maps, prepared by the U.S. Geological Survey in cooperation with the Mississippi Department of Natural Resources, Bureau of Land and Water Resources, delineating the potentiometric surfaces of the major aquifers in Mississippi. In the outcrop area of the Ripley aquifer the potentiometric surface is strongly affected by recharge from precipitation, by topography, and by drainage of the aquifer by streams. The potentiometric surface slopes generally to the west away from the area of outcrop and is mildly affected by pumpage from wells and by discharge of flowing wells in the valleys. Historically, water levels in or near the outcrop have shown little or no long-term changes. (USGS)
W81-00358

POTENTIOMETRIC MAP OF THE GORDO AQUIFER IN NORTHEASTERN MISSISSIPPI, SEPTEMBER, OCTOBER, AND NOVEMBER 1978,
Geological Survey, Jackson, MS. Water Resources Div.
B. E. Wasson.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO. 80225. Paper copy $2.50, microfiche $0.50. Geological Survey Open-File Report 79-1586 (WRI), 1980. 1 Sheet, 9 Ref.

Descriptors: *Maps, *Potentiometric level, *Aquifers, *Groundwater, *Mississippi, Water resources, Natural recharge, Observation wells, Water level fluctuations, Hydrogeology, Hydrographs, *Gordo aquifer(MS).

This potentiometric map of the Gordo aquifer in northeastern Mississippi is the second in a series of maps, prepared by the U.S. Geological Survey in cooperation with the Mississippi Department of Natural Resources, Bureau of Land and Water Resources, delineating the potentiometric surfaces of the major aquifers in Mississippi. The potentiometric surface of the Gordo aquifer slopes generally to the west away from the outcrop area and it is depressed generally by large ground-water withdrawals in the Tupelo and Columbus areas. Historically, water levels in or near the outcrop of the Gordo aquifer have shown little or no long-term changes. Heavy withdrawals from the downdip area have caused long-term water-level declines of 1 to 2 feet per year in much of the confined part of the aquifer. Water-level decline in one observation well in Tupelo has averaged about 5 feet per year since 1966. (USGS)
W81-00359

2G. Water In Soils

FORESTED WETLANDS IN EASTERN CONNECTICUT: THEIR TRANSITION ZONES AND DELINEATION,
GCA Corp., Bedford, MA. GCA Technology Div.
For primary bibliographic entry see Field 2I.
W81-00272

AN INSTRUMENTED LYSIMETER SYSTEM FOR MONITORING SALT AND WATER MOVEMENT,
Science and Education Administration. Kimberly,

ID. Snake River Conservation Research Center.
C. W. Robbins, and L. S. Willardson.
Transactions of the American Society of Agricultural Engineers, Vol 23, No 1, p 109-111, January-February 1980. 4 Fig, 7 Ref. OWRT-B-148-UTAH(2), 14-34-0001-7195.

Descriptors: *Lysimeters, *Equipment, *Soil water movement, *Salinity, Laboratory equipment, Instrumentation, Design, Construction, Salts, Weight, Conductivity, Soils, Soil science.

A lysimeter system was described that consists of four continuously weighing lysimeters mounted on a portable platform. The lysimeters, made from low pressure PVC irrigation pipe (1.18 m deep by 0.31 m dia), are placed on a hydraulic weighing system that consists of either a water-filled rubber pillow or an automotive innertube connected to a water column. The sensitivity of the weighing system is 0.1 kg or an equivalent water depth of 1.4 mm. One-bar ceramic cups, placed in the center of the lysimeters at 0.25, 0.50, and 0.75 m from the soil surface, are connected to the outside for soil solution sampling. Eight small bolts symmetrically located around the lysimeter at the same depths as the ceramic cups serve as 'four probe' contacts for electrical conductivity measurements. The cost of each set of four lysimeters in 1978 was about $400. (Sims-ISWS)
W81-00273

THE EFFECT OF NITRATE ON NITROUS OXIDE REDUCTION IN ORGANIC SOILS AND SEDIMENTS,
Agricultural Research and Education Center, Belle Glade, FL.
For primary bibliographic entry see Field 2K.
W81-00311

INFLUENCE OF SIZE OF GYPSUM PARTICLES ON THE HYDRAULIC CONDUCTIVITY OF SOILS,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water.
R. Keren, J. F. Kreit, and I. Shainberg.
Soil Science, Vol 130, No 3, p 113-117, September, 1980. 3 Fig, 1 Tab, 6 Ref.

Descriptors: *Hydraulic conductivity, *Gypsum, *Soil types, Particle size, Loam, Foreign research, Calcium compounds, Hydrology, Pores, Soil physical properties, Leaching.

The influence of gypsum fragments and content on the hydraulic conductivity of soils before the gypsum has dissolved was studied in a loamy soil and a sandy loam soil, both from the coastal plain of Israel. The soils were mixed with gypsum to bring the gypsum content to 1, 5, or 10% of the sample. Two ranges of particle sizes were used: less than 44 micrometers or 0.25-1.0 mm in diameter. Soils were packed into columns, covered with quartz sand, flushed with carbon dioxide and subsequently wetted from the top by flooding the surface with 0.0025 M CaC12 solution in air-free water. The hydraulic conductivity of the soils increased with the dissolution of gypsum from the column. The initial relative hydraulic conductivity in both soils containing 5 and 10% gypsum decreased to 35 and 20%, respectively. The loam soil was more sensitive to gypsum content. Large pores in the sandy loam soil more easily accommodated the gypsum fragments without a drop in the hydraulic conductivity. As the content of gypsum increased, the difference between the soils disappeared. When mixed with the larger fragments of gypsum, the hydraulic conductivity of both soils was almost unaffected, suggesting that the effect of the gypsum particle is mainly physical and the decrease in initial hydraulic conductivity was due to plugging of the soil pores with gypsum particles. (Baker-FRC)
W81-00413

SALINITY EFFECTS ON HYDRAULIC PROPERTIES OF SOILS,
New Mexico State Univ., Las Cruces. Dept. of Agronomy.
C. S. Park, and G. A. O'Connor.
Soil Science, Vol 130, No 3, p 167-174, September, 1980. 6 Fig, 3 Tab, 15 Ref.

Descriptors: *Groundwater movement, *Salinity, *Hydraulic conductivity, *Soil texture, Permeability, Porosity, Soil physical properties, Sands, Clays, Rain water, Water types, Saturated flow, Hydrology, Physical properties.

Four soils ranging from sand to clay were used to study saturated hydraulic conductivity (HC) and infilitration rates with five saline-sodic waters representative of the saline groundwaters in New Mexico. The waters contained dissolved solids in amounts ranging from 1,250 to 15,000 mg/liter. SAR values ranged from 16 to 57. Water quality did not significantly affect the saturated soil HC as long as these waters remained the sole source of irrigation water. Swelling was kept to a minimum so long as the electrolyte concentration remained above the threshold value. The passage of 1 pore volume of high quality water, representative of rain water, through the test soils caused a significant reduction in saturated HC. In Sheppard sand, HC values at 1 pore volume of drainage were reduced by 25-35%. Very sandy soils were the least affected. As this decrease was not reversible, it was thought that dispersion, rather than swelling, was responsible for the decreased HC. Swelling was an important mechanism only in clay soils. It was concluded that, where saline-sodic water is the dominant source of irrigation and is supplemented by rains, all combinations of saline-sodic water could be used on very sandy soils, while no saline-sodic waters should be used on fine-textured soils, and only slightly sodic waters would be successful on medium-textured soils. (Baker-FRC)
W81-00415

2H. Lakes

OCCURRENCE AND REGULATORY ROLE OF CYCLIC ADENOSINE MONOPHOSPHATE IN THE NUTRIENT DYNAMICS OF CONTROLLED AND NATURAL COMMUNITIES OF LAKES,
Michigan State Univ., Hickory Corners. W. K. Kellogg Gull Lake Labs.
R. G. Wetzel, and D. A. Francko.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-120586, Price codes: A04 in paper copy, A01 in microfiche. Institute of Water Research, Michigan State University, Project Completion Report. October, 1980. 51 p, 16 Fig, 9 Tab. OWRT A-103-MICH(1), 14-34-0001-9024, 0124.

Descriptors: *Algae, Macrophytes, Cyanophyta, Nitrogen, *Nutrients, *Phosphorus, Nutrient limitations, *Lakes, Phytoplankton, Alkaline phosphatase activity, Chlorophyll, Phosphates, *Adenosine monophosphate.

Cyclic adenosine 3':5'-monophosphate (cAMP) was found in both cellular and dissolved forms in cultures of several species of green and blue-green algae. Quantities of both cellular and dissolved cAMP varied interspecifically under similar culture conditions and intraspecifically under differing culture conditions and at different stages of cell growth. Similar quantities of tissue and filtrate cAMP were found in several species of aquatic vascular plants and aquatic bacteria. In the epilimnia and littoral zones of two trophically dissimilar aquatic systems, cAMP was found in both particulate-associated and dissolved phases in lakewater samples. Both cAMP fractions varied greatly in concentration both seasonally and between the lakes. Particulate cAMP levels were largely due to algal cAMP content, while dissolved cAMP in epilimnetic and littoral lakewater samples resulted from combined release by algae, aquatic macrophytes, bacteria and other autochthonous sources. Most of the total cAMP was found in the dissolved phase during all times of the year. Cellular cAMP levels in the blue-green alga Anabaena flos-aquae were enhanced upon inoculation into N-free, but not P-free media. Cellular cAMP levels also increased upon inoculation into fresh media containing non-limiting nutrient concentrations. Cellular cAMP levels in Anabaena were exponentially correlated with 14C-bicarbonate uptake. In oligotrophic Lawrence Lake, particulate cAMP levels were linearly correlated to 14C-primary productivity rates in the epilimnion on a seasonal basis. In Lawrence Lake and hypereutrophic Wintergreen Lake, particulate cAMP levels in certain phytoplankton associations were linearly correlated to alkaline phosphatase specific activity and chlorophyll a content. Cyclical changes in particulate and dissolved cAMP levels corresponded to changes in phytoplankton abundance and community composition.
W81-00266

STRATIFIED BIDIRECTIONAL SEEPAGE FLOW THROUGH AN EARTHEN EMBANKMENT,
Lowe (Roger) Associates, Inc., Bellevue, WA.
J. T. Cameron, C. T. Kincaid, and G. Z. Watters.
In: Finite Elements in Water Resources, Volume 1; Preprints of the Third International Conference (2 Vol), Mississippi University, Oxford, May 19-23m 1980. p 2.127-2.136, 1980. 10 Fig, 1 Tab, 4 Ref. Science and Education Administration, New Orleans, Louisiana. OWRT B-139-UTAH(9), 14-34-0001-7191.

Descriptors: *Seepage, *Embankments, *Great Salt Lake, *Model studies, Saline water-freshwater interfaces, Mathematical models, Analytical techniques, Groundwater movement, Porous media, Lakes, Salinity, Density, Pressure, Hydraulic conductivity, Interfaces, Stratification, Stratified flow, Causeways.

From the early years of this century until 1959, Great Salt Lake West of Promontory was spanned by the Southern Pacific Railroad on a wooden trestle. For reasons of maintenance and vulnerability to fire, an earthen causeway was constructed replacing the 12-mile long trestle. Originally designed to permit a free exchange of salt brines between the northern and southern bodies of water, the embankment presently restricts the flows. Since freshwater recharge to this terminal lake predominantly enters the southern arm, an elevation gradient drives a northward flow through the upper zone of the causeway. The greater salinity concentrations which have evolved in the northern arm have given rise to a density gradient which drives a southward flow through the lower zone of the causeway embankment. The objective of this study was the numerical simulation of this stratified bidirectional seepage flow through the earthen embankment. Specifically, a two-dimensional finite element model of stratified flow in porous media was developed. Discharges, free surface and interface locations were predicted as functions of fluid densities and lake surface and interface elevations. (See also W80-06858) (Sims-ISWS)
W81-00270

LAKE SAMMAMISH RESPONSE TO WASTEWATER FIVERSION AND INCREASING URBAN RUNOFF,
Washington Univ., Seattle. Dept. of Civil Engineering.
E. B. Welch, C. A. Rock, R. C. Howe, and M. A. Perkins.
Water Research, Vol 14, No 7, p 821-828, 1980. 3 Fig, 2 Tab, 19 Ref. OWRT-B-068-WASH(2). EPA R-800512.

Descriptors: *Lakes, *Water pollution sources, Watersheds(Basins), *Washington, Storm runoff, Urban runoff, Waste water disposal, *Phosphorus, Diversion, On-site investigations, Data collctions, Analysis, *Phytoplankton, Water quality, Sampling, Algae, Cyanophytes, *Lake Sammamish(WA).

Lake Sammamish has shown a decrease in its mean annual concentration of phosphorus following diversion of about one-third of the external loading in 1968. During 1971-1975 the P concentration averaged 27 micrograms/l, in contrast to the prediversion (1964-1966) concentration of 33 micrograms/1, and may be equilibrating near the predicted steady-state concentration of 22 micrograms/l. Neither phytoplankton biomass or Secchi

visibility has changed following diversion; however, the blue-green component of the phytoplankton decreased by nearly 50%. The failure of biomass and visibility to improve is probably a result of similar pre- and postdiverson winter-spring epilimnetic P concentrations. The marked reduction in P since diversion occurred during and prior to fall overturn and may have represented a supply or P for later summer early fall blue-green algal populations that declined after diversion. Runoff from a rapidly developing westside portion (18%) of the watershed is contributing substantially to P loading of the lake. Development to a density of about ten dwellings/ha has increased loadin possibly on the order of 14%. Future development of the eastside portion (26% of watershed) may increase loading by 20% and be equivalent to nearly one-half of the P previously diverted in 1968. (Humphreys-ISWS)
W81-00274

ENHANCEMENT OF RELEASE WATER QUALITY BY LOCALIZED MIXING LAKE OKATIBBEE, MS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
S. C. Wilhelms.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 97-100 (1979) 4 Fig, 1 Tab.

Descriptors: *Stratification, *Water quality, *Garton pump, *Discharge(Water), Dissolved oxygen, Hypolimnion, Epilimnion, Thermal stratification, Mixing, Destratification, Turbulence, Pumping, Water circulation.

A low-energy mechanical pump, the Garton pump, was used to demonstrate that localized mixing near a fixed low-level outlet will enhance the quality of low flow releases by mixing water from the epilimnion with water from the hypolimnion. Thermal stratification can result in a hypolimnion with zero dissolved oxygen and high levels of hydrogen sulfide, iron, and manganese. Release of such low quality water without mixing can result in poor water quality downstream,Lake Okatibbee, near Meridian, Mississippi, was used for the demonstration. It is a shallow lake with a fixed low-level intake, a horseshoe-shaped conduit, and a stilling basin. The Garton pump was attached to the upstream face of intake structure to pump water from the surface toward the bottom. A Hydrolab Surveyor Model 6D Water Quality Analyzer and a Yellow Springs Instrument (YSI) D. O.-Temperature meter were used along with titration to take water quality measurements. Results show a definite improvement in released water quality where the fan is used. Approximately 50% of the outlet fow was estimated to be epilimnion water. Important design factors include the relationship between discharge rate and release rate, pump thrust, and pump discharge penetration depth. (See also W81-00290) (Seigler-IPA)
W81-00309

A TROPHIC CLASSIFICATION OF MINNESOTA LAKES BASED ON LAKE SEDIMENTS,
Minnesota Univ., Minneapolis. Limnological Research Center.
H. E. Wright, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124141, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, July, 1980. 20 p, 4 Fig, 1 Tab, 22 Ref. OWRT-B-128-MINN(1), 14-34-0001-7164.

Descriptors: *Minnesota, *Lake morphology, *Lake sediments, *Diatoms, *Bioindicators, Correlation analysis, Sampling bodies of water, Lakes, Lake beds, Microorganisms, Aquatic life, Microbiology, Water sampling, Assay, Statistical methods, Chemical analysis, Ecological distribution, Sediment, Diatomaceous earth, Bottom sediments, Water chemistry, Eutrophication.

The lakes sampled were selected to be representative of the wide variety of Minnesota lake types. Sediments were sampled in each of 105 lakes in the deepest water. The surface sediment samples were analyzed for diatoms, and water samples from the same lakes were chemically analyzed. Correlation between the two series by cluster analysis provided the ecological basis for the use of diatom assemblages to classify lakes. Deep oligotrophic lakes were characterized by Cyclotella comta; dilute acid lakes were characterized by Melosira distans, Meloshira italica, Tabellaria fenestrata, Cyclotella stelligera, and Cyclotella glomerata; and highly entrophic lakes were characterized by Stephanodiscus hantzschii. Diatom analysis of lake sediment cores could then be used to reconstruct past lake conditions, and thus evaluate the changes in lake trophic status as a result of pollution and changes induced by natural climatic and hydrologic factors. The results showed that Stephanodiscus hantzschii was a consistent indicator of cultural eutrophication. (Zielinski-IPA)
W81-00322

DIFFERENTIAL C02 AND 02 BENTHIC COMMUNITY METABOLISM IN A SOFT-WATER LAKE,
Connecticut Univ., Storrs. Biological Sciences Group.
P. H. Rich.
Journal of the Fisheries Research Board of Canada, Vol 36, No 11, p 1377-1389, 1979. 8 Fig, 5 Tab, 51 Ref. OWRT-A-071-CONN(4), 14-31-0007-6007.

Descriptors: *Respiratory quotients, *Carbon dioxide, *Dissolved oxygen, Biochemical oxygen demand, Oxygen demand, Photosynthesis, Cyanophyta, Anaerobic conditions, *Lakes, Aerobic conditions, Stratification, Metabolism, Respiration, Connecticut, Dunham Pond(CT).

Respiratory quotients (RQ = C02 released/02 taken up) were examined for Dunham Pond, a small, softwater lake in the eastern Paleozoic highlands of Connecticut. Samples were taken weekly or every two weeks from January 1973 to April 1976 at stations located centrally, at the inlet streams, and at the outlet. Light meaurements were made with a cadmium sulfide cell and Secchi disk. Measurements of temperature, conductivity, dissolved oxygen, dissolved carbon dioxide, and chemcal oxygen demand were also made. Surface sediment samples were taken at 3.5 m with a free-fall core sampler. Results show that less than 1% surface light exists below 2.5 m due to high concentrations of dissolved and colloidal humic organic matter. During the summer, C02 accumulation was found to be greater than 02 removal in the hypolimnion. During winter stratification this condition exists for the whole lake. C02 uptake was fond in situ in sediment surface incubations at 3.5 m. This was associated with the anaerobic photosynthesis of an epipelic mat of blue-green algae. The RQ of the lake community was greater (.85) than expected due to the mixed community of aerobes and anaerobes. The higher than expected RQ describes the amount of metabolism for which oxygen has not yet been the terminal electron acceptor. (Seigler-IPA)
W81-00341

HYDROLOGIC BUDGET FOR EAGLE LAKE NEAR WILLMAR, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
C. F. Myette.
Available from OFSS, Box 25425, Fed. Ctr., Denver, CO 80225, paper copy $2.00, microfiche $3.50. Geological Survey Open-File Report 80-163, 1980. 13 p, 4 Fig, 1 Tab, 11 Ref.

Descriptors: *Hydrologic budget, *Lakes, *Minnesota, *Eutrofication, *Hydrologic equation, Darcys law, Streamflow, Flow nets, Hydrogeology, Glacial drift, *Eagle Lake (MN), Hawk Creek(MN), Willmar(MN).

Eagle Lake occupies 890 acres of a 9,000-acre watershed in central Minnesota. Because of its proximity to Willmar, many homes and summer cabins have been built around the lake. Presently (1978), the shore is more than 90 percent developed. One effect of this development is accelerated eutrophication, most commonly shown by algae blooms. An annual hydrologic budget for Eagle Lake was prepared for the 1978 water year in support of a nutrient study prepared by the University of Minnesota at Morris. Results show that the amount of water that flowed through Eagle Lake in the 1978 water year was 6,670 acre-feet. Inflow to the lake was 45 percent surface water, 22 percent ground water, and 33 percent precipitation. Outflow was 73 prcent surface water, 25 percent evaporation, and slightly greater than 2 percent net change in lake storage. Estimates for the ground-water component were derived both as a residual in the hydrologic-budget equation and by flow-net analyses. The residual value of 1,450 acre-feet compared favorably with the flow-net value of 1,400 acre-feet. (USGS)
W81-00365

VARIABILITY IN MICROBIOLOGICAL DATA FROM A STRATIFIED EUTROPHIC LAKE,
Freshwater Biological Association, Ambleside (England).
J. G. Jones, and B. M. Simon.
Journal of Applied Bacteriology, Vol 49, No 1, p 127-135, August, 1980. 6 Fig, 1 Tab, 23 Ref.

Descriptors: *Microbiology, *Lakes, *Eutrophication, Bacteria, Chlorophyll, Hypolimnion, Limnology, Thermal stratification, Oxygen, Lentic environment, Sediments, Sampling, Analytical techniques, Water quality, Lake stages, Seasonal.

The degree of variability in direct bacterial counts, electron transport system activity, ATP levels, chlorophyll a concentration, and chemiluminescence was studied in a stratified eutrophic lake. The Blelham Tarn, Cumbria (England) is 0.67 km long and averages 14.5 m in depth. In summer, it becomes thermally stratified, and the hypolimnion is deoxygenated, usually to within 5 m of the surface. In August, sediment and water column samples were taken at seven points along a line transecting the tarn, and heterogeneity in the horizontal and vertical dimensions was examined. The scale of variability was compared with intra- and inter-sample errors. For samples taken at a single site, the coefficient of variation was often as great as the variability found between sites in a transect across the lake, especially for sediments. Seasonal variability in sediment activity was comparable to coefficients of 30% and greater reported for oxygen uptake in previous experiments. It has been suggested that thermal stratification and deoxygenation of the hypolimnion may affect sediment microbiota to an even greater degree than that in the water column. The results of this study should indicate the number of sampling as needed to achieve a given degree of precision when examining microbiological parameters of a stratified lentic system. (Geiger-FRC)
W81-00405

PHYSIOLOGICAL ADAPATATIONS IN RESPONSE TO ENVIRONMENTAL STRESS DURING AN N2-FIXING ANABAENA BLOOM,
North Carolina Univ., at Morehead City. Inst. of Marine Sciences.
P. E. Keller, and H. W. Paerl.
Applied and Environmental Microbiology, Vol 40, No 3, p 587-595, September, 1980. 4 Fig, 4 Tab, 46 Ref.

Descriptors: *Anabaena, *Lakes, *Eutrophication, *Nitrogen fixation, Adaptation, Algae, Aquatic plants, Carbon dioxide, Diurnal, Carbon fixation, Photosynthesis, Oxygen demand, Radiation, Dissolved oxygen, Epilimnion, Leutic environment, Phytoplankton.

The heterocystous blue-green algae, Anabaena spiroides has been shown to maintain prolonged and intense biomass production in the epilimnion of a eutrophic lentic environment (Thompson Lake, Ontario) that caused photooxidative death to many phytoplankton. Chlorophyll-a was protected from photooxidation by increased carotenoid production in A. spiroides, which retarded catalysis of other cell photooxidative reactions. Maximum use of photosynthetic active radiation (PAR) was achieved by temporally separating carbon dioxide and elemental nitrogen fixation. Carbon dioxide fixation was at a maximum in the morning before the afternoon buildup of dissolved oxygen, while

elemental nitrogen fixation, being less oxygen sensitive, peaked during the afternoon, after maximum incident PAR levels were reached. The advantages of the diurnal partitioning of carbon and elemental nitrogen fixation are the minimization of competition for reductant-generating compounds and the ample supply of carbon skeletons to accept fixed ammonia. Thus, survival of Anabaena in eutrophic waters was attributed to physiological factors, namely the utilization of radiant energy for reproduction and the ability to dominate surface waters by shading deeper phytoplankton during summer blooms. (Geiger-FRC)
W81-00449

OXYGEN EXCHANGE BETWEEN A 'MODEL' POND AND THE ATMOSPHERE,
Science and Education Administration, Durant, Southern Plains Watershed and Water Quality Lab.
For primary bibliographic entry see Field 2D.
W81-00495

2I. Water In Plants

FORESTED WETLANDS IN EASTERN CONNECTICUT: THEIR TRANSITION ZONES AND DELINEATION,
GCA Corp., Bedford, MA. GCA Technology Div.
P. H. Anderson, M. W. Lefor, and W. C. Kennard.
Water Resources Bulletin, Vo 16, No 2, p 248-255, April 1980. 1 Fig, 4 Tab, 17 Ref. OWRT A-058-CONN(4), 14-31-0001-4007.

Descriptors: *Wetlands, *Forests, *Vegetation, *Soil water, *Connecticut, On-site investigations, On-site data collections, Data processing, Mathematical models, Analytical techniques, Moisture content, Soils, Soil moisture, Soil chemistry, Soil science, Freshwater wetlands, Wetland delineation, Forested wetlands, Discriminant analysis.

The delineation of inland wetlands requires close field examination of the biological and physical gradients (transition zones) between wetlands and bordering uplands. As part of a study on the detection and delineation of inland wetlands in eastern Connecticut by remote sensing techniques, this effort was designed to investigate vegetation distribution and composition and selected physical and chemical properties of the soils of wetland to upland transition zones in deciduous wetland forests. Field research was conducted during the growing season of 1975 within a test area consisting of the 45-sq mi Town of Mansfield, Connecticut. Changes in vegetation composition and structure, soil pH, and soil water content were determined along line transects extended over wetland to upland transition zones. Differences in soil pH occurred along the transects but were of such magnitude that they probably have little impact on plant distribution. There were significant changes in soil water content along the wetland to upland gradients. Discriminant analysis applied to statistical 'index of abundance' data describing vegetation distribution among the various zones (wetland, transition, upland) showed which plant species best distinguish wetlands from uplands. Of the criteria studied, vegetation composition and distribution, soil water content, and relief are the most useful criteria for delineating deciduous wetland forests. (Sims-ISWS)
W81-00272

WATER CONSERVATION THROUGH PLANT BREEDING - ALFALFA,
New Mexico State Univ., Las Cruces.
M. Wilson, and B. Melton.
In: A Quarter Century of Water Research. Proceedings of the Twenty-Fifth Annual New Mexico Water Conference. Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 105-108. New Mexico Resources Research Institute, New Mexico State University, Box 3167 Las Cruces, NM 88003.

Descriptors: *Alfalfa, *Plant breeding, *Genetics, *Moisture availability, *Agriculture, *Planting management, Water requirements, Phenology, Irrigation systems, Crop response, Adsorption, Crop production, Phylogeny.

The need for water conservation has forced plant breeders to reevaluate management systems which utilize large quantities of water in an effort to obtain maximum production. Alfalfa normally requires large amounts of water for optimum production, however, many studies have commented on its drought resistance. This illustrates the possibilities of genetic variability that may occur as a result of diverse moisture conditions. Significant differences were obtained among twenty-four alfalfa varieties evaluated under 16, 48 and 80-acre-inch per year irrigation regimes. These results suggest that by genetic manipulation, it may be possible to devlop varieties which will perform better than existing varieties under limited moisture conditions. Further evidence of useful plant variation was obtained by comparing plants selected from differing screening procedures. Field and greenhouse tests have been established to evaluate the extent to which these results will be transmitted to the next generations. (Vernale-Omniplan)
W81-00396

2J. Erosion and Sedimentation

GEOLOGIC AND GEOMORPHIC ASPECTS OF STREAMBANK EROSION IN THE YAZOO HILL STREAMS,
Army Engineer District, Vicksburg, MS. Potamology Section.
R. E. Rentschler.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 43-48, (1979) 21 Fig.

Descriptors: *Mississippi, *Yazoo Basin, *Erosion control, *Bank erosion, Bank stability, Degradation(Stream), Stream erosion, Erosion rates, Stream stabilization, Stream improvement, Geologic formations, Rocks, Cutoffs, Channel improvement.

A series of grade control structures are being constructed and studied on several Yazoo Hill Streams in an attempt to develop methods for controlling the serious erosion in the area. For the past 150 years the Yazoo Basin in Mississippi has suffered an accelerated rate of erosion due to early agricultural practices. The main factor in stream bank erosion in the area is bed degradation, much of which was caused by man straightening, channelizing, or in some way altering the stream. Channel straightening and cutoffs have severely damaged the upper reaches of South Fork Tillatoba Creek. The construction of a cutoff changed the stream's natural slope, alternate bar sequence, sediment movement, and channel geometry. A series of aerial photographs illustrate this example. In general, the hill streams of the Yazoo area have a definite lack of stabilizing geologic formations within their channels. Bedrock in the channels is predominantly a poorly cemented iron sandstone. Bank erosion is directly related to the resistance of the materials in the bed and the banks. Prior to any form of stream improvement, the composition of the bed should be studied as a key to future stream conditions. (See also W81-00290) (Seigler-IPA)
W81-00299

SEDIMENT SOURCES AND YIELDS FROM UPLAND WATERSHEDS IN NORTH MISSISSIPPI,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
F. E. Dendy, S. J. Ursic, and A. J. Bowie.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 49-54, (1979) 6 Fig, 4 Tab, 12 Ref.

Descriptors: *Mississippi, *Sediment yield, *Watersheds(Basins), Sediment load, Land use, Sediment transport, Erosion, Gullies, Rainfall, Runoff, Forests, Pastures, Soil erosion, Mathematical studies.

Nineteen small unit source watersheds and five large mixed-cover watersheds located in the Pigeon Roost Creek basin in Marshall County, Mississippi, were used to show that sediment yields from small unit source watersheds can be used to predict sediment yields from the large watersheds. Of the small watersheds, one was in pasture, two in cultivation, and sixteen in abandoned fields and forest. The large, mixed-cover watersheds ranged in size from 1000 to 22,800 acres with 20 to 25% cultivated, 40 to 50% pasture or idle, and 30 to 40% forest. Annual rainfall, runoff, and sediment yields for the small watersheds are summarized. Large differences in runoff among land uses are evident. Annual sediment yields in the small watersheds ranged from a few pounds per acre from forest land to 43 tons per acre for cultivated land. Annual runoff-sediment relationships from the small watersheds were used to compute sediment yields for the five large watersheds. Computed yields and measured yields compared favorably. In the large watersheds, cultivated land, gullies, and stream channels composed 25% of the area and contributed 95% of the sediment yield. Pasture-idle land with 38 to 50% of the total area contributed 5% of the sediment yield and forest land, 25 to 43% of the area, contributed only 0.2% of the sediment yield. (See also W81-00290) (Seigler-IPA)
W81-00300

RUNOFF COMPOSITION OF SOYBEAN MANAGEMENT SYSTEMS ON LEEPER CLAY LOAM SOIL,
Science and Education Administration, Oxford, MD. Sedimentation Lab.
M. J. M. Romkens, J. Y. Wand, F. D. Whisler, N. W. Buehring, and J. K. Young.
In: Proceedings, 14th Annual Mississippi River Resources Conference, 24-25, September 1979. p 55-59, (1979) 3 Fig, 6 Tab, 9 Ref.

Descriptors: *Rainfall-runoff relationships, *Sediment load, *Sediment transport, Soil erosion, Surface runoff, Loam, Soybeans, Wheat, Agriculture, Phosphorus, Nitrogen, Clays, Sediment yield, Nutrient removal.

Soil loss and the chemical composition of runoff were studied for various tillage management systems on bottomland during simulated rainstorms. Soil erosion and runoff have traditionally been studied for sloping uplands but concern about the transport of agricultural chemicals in low-land areas such as soybean bottomlands is growing. One tillage management system studied used double cropping with soybeans and wheat. The other system, minimum tillage, was identical except that no wheat was planted. A fallow system was also tested. Two 60-minute simulated rainstorms were applied. Between 20 and 25 'grab' samples were collected per plot for each storm. Samples were analyzed in the laboratory for sediment concentration, dissolved solids, and the nitrogen, phosphorus, and potassium content of the water and/or sediment. Chemical or sediment concentrations were integrated over the hydrograph or sedigraph to determine total losses. Results show that soil loss from the minimum tillage was substantially less than from the fallow system. Nutrient loss from both the double cropping and minimum tillage systems was substantial. The clay content of sediment was found to increase as sediment yield decreased. (See also W81-00290) (Seigler-IPA)
W81-00301

SOME APPLICATIONS OF THE CONCEPT OF GEOMORPHIC THRESHOLDS,
S. A. Schumm.
In: Thresholds in Geomorohology, p 473-485, 1980. 7 Fig 27 Ref. Ge, 27 Ref. George Allen and Unwin, London, OWRT-B-150-COLO(3), 14-34-0001-7143.

Descriptors: *Geomorphology, *Thresholds, *Erosion, *Deposition(Sediments), Terraces(Geologic), Gullies, Slopes, Glaciers, Hydrogeology, Forecasting, Land farming, Meanders, Sedimentology, Cutoffs, Arroyos.

The concept of geomorphic thresholds, thresholds of landform stability that are exceeded either by progressive change of the landform or by change in an external variable, can be applied to both

geomorphic and land management problems to identify those conditions at which a landform is incipiently unstable. If the threshold is crossed due to internal influences, the threshold is intrinsic. If the threshold is crossed due to a change in an external variable, the threshold is external. Threshold an episodic erosion can be used to explain anomalous erosion and deposition changes whether as a result of man's activities or as a normal part of landscape evolution. To advise engineers and land manager's a geomorphologist must identify the type of geomorphic threshold that is causing a change such as fan-head trenching, arroyo cutting, gully development, stream capture, pattern change, and meander cutoff. Rivers near the threshold of pattern change, such as the Chippea River in Wisconsin, can be identified to aid in planning. Also, the geomorphologist considers the fact that erosion or deposition are not always progressive. The crossing of thresholds in high-relief areas may produce episodic erosion or deposition. (Seigler-IPA)
W81-00342

A FIELD CALIBRATION OF THE SEDIMENT-TRAPPING CHARACTERISTICS OF THE HELLEY -SMITH BEDLOAD SAMPLER,
Geological Survey, Lakewood, Co. Water Resources Div.
W. W. Emmett.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.25. Geological Survey Professional Paper 1139, 1980. 44 p, 48 Fig, 13 Tab, 13 Ref.

Descriptors: *Bed load, *Bed load samplers, *Trap efficiency, *Fluvial sediments, *Particle size, Sedimentation rates, Sediment discharge, Measurement, Streamflow, Data collections, *Helley-Smith bedload sampler, *Conveyor-belt bedload sampler, *East Fork River(WY).

For sediment particle sizes between 0.50 mm and 16 mm, the Helley-Smith bedload sampler has a near perfect sediment-trapping efficiency. For particles sizes smaller than 0.50 mm, the Helley-Smith sampler has a high bedload sediment-trapping efficiency because part of the sediment retained by the sampler has been transported in suspension and it cannot be quantified separately from the bedload. For particle sizes larger than about 16 mm, the Helley-Smith sampler has low sediment-trapping efficiency but this may be related to the paucity of coarse particles in transport in the calibration tests rather than reflecting an actual low trap efficiency for large-size particles. (USGS)
W81-00363

CONSERVATION IMPACTS AND PRACTICES OF SAND REMOVAL FROM DRY BED OKLAHOMA RIVERS,
Oklahoma State Univ., Stillwater.
J. Harp, and R. C. Chang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124158, Price codes: A03 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute, Oklahoma State University, Technical Completion Report, September 1980. 34p, 4 Fig, 2 Tab, 24 Ref. OWRT-A-092-OKLA(1), 14-34-0001-0138.

Descriptors: *Channel improvements, *Dry beds, Flood plains, Guidelines, Streambeds, Meandering, Physical impacts, Regulations, Removal, Rules, *Sand mining, Effects, *Streamflow, *Sedimentation, Siltine, Urbanization, Storm runoff, Channel flow, Oklahoma.

An analysis of the response of a river system to sand mining requires establishing the morphology and hydraulics of the system prior to man's activities. The complexity of alluvial channel flow and the dynamic nature of river systems are reflected in the large number of interrelated variables necessary to describe natural streams. A number of interdependent factors responsible for changes in channel characteristics are discussed. As a general effect, sand mining decreases the local flow velocity with an attendant increase in flow capacity and more water storage becomes available. The long-term impact depends on the rates of sand removal and natural supply. Overmining results in lowering the base level for upper reaches and tributaries. The reduction of bedload will induce the down stream tendency to decrease the channel width-to-depth ratio and increase the sinuosity. An understanding of the meandering process reveals the best-location and time for mining sand. Not all sand removal activities are detrimental. In fact, if under proper guidance, sand mining can act as a flood plain management factor and produce overall benefits. A set of guidelines for prudent sand mining is presented.
W81-00380

KNICKPOINT MIGRATION DUE TO BASELEVEL LOWERING,
Geological Survey of Israel, Jerusalem.
Z. B. Begin, D. F. Meyer, and S. A. Schumm.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 106, No WW3, Proceedings Paper 15651, p 369-388, August 1980. 18 Fig, 26 Ref, 2 Append.

Descriptors: *Erosion, *Streams, *Model studies, Mathematical models, Hydraulic models, Flumes, Gullies, Sediments, Sediment discharge, Flow, Topography, Channel morphology, Environmental engineering, Agricultural engineering, *Sediment transport, Knickpoint migration.

The migration of knickpoints in alluvial channels was studied in 15-m and 20-m long flumes, sloping at 0.01 cm/cm. The channels were formed in response to baselevel lowering with two modes of migration: (1) migration of a constant vertical knickpoint and (2) migration of an initially vertial knickpoint which flattens and is finally eliminated. Each mode of migration was described by a different equation of motion, which results in a different migration curve. The rate of knickpoint migration hinges upon the channel ability to transport downstream the sediments supplied to it by the receding knickpoint. In this context the mechanism of transport is very important, because wash load is essentially independent of channel attributes. This study showed that in response to baselevel lowering, a knickpoint migrates upstream at a decreasing rate even when water discharge remains constant, and the rate is also affected by the shape of the knickpoints. (Sims-ISWS)
W81-00401

PARTICLE TRANSPORT FROM THE WEST AFRICAN SHELVES OF LIBERIA AND SIERRA LEONE TO THE DEEP SEA: A CHEMICAL APPROACH,
University of South Florida, St. Petersburg. Dept. of Marine Science.
D. W. Eggimann, P. R. Betzer, and K. L. Carder.
Marine Chemistry, Vol 9, No 4, p 283-306, August, 1980. 5 Fig, 3 Tab, 39 Ref, 1 Append.

Descriptors: *Suspended solids, *Sediment transport, *Continental shelf, *Continental slope, Marine geology, Africa, Chemical analysis, Oceans, Aluminum, Iron, Magnesium, Manganese, Silicates, Inorganic compounds, Mineralogy, Tracers, Basin.

Suspended particle transport through the sea was examined over a 480-km section of the Liberia-Sierra Leone continental shelf off West Africa using the chemical and mineralogical composition of the particles as tracers. Ratios of Si/Al, Fe/Al, Mg/Al, and Mn/Al were used to detect shelf-derived matter in slope waters. The use of light-scattering and particle-mass measurements was not applicable to most of the material analyzed, so that chemical identification of particulates was necessary. Suspended particulates and sediments from the adjacent eastern Atlantic basin were similar in chemical and mineralogical composition to those in the water column seaward of the West African continental shelves. However, these basin specimens were distinct from Sahelian dust, which is thought to be the main source of sedimentary matter for tropical and semi-tropical regions of the deep eastern basin. These results indicate that shelf input of matter to the deep sea may be greater than was previously suspected. (Geiger-FRC)
W81-00454

ASPECTS OF DRAINAGE BASIN MORPHOMETRY OF RELEVANCE TO ARCTIC HYDROLOGY,
Winnipeg Univ. (Manitoba).
W. Rannie.
In: Proceedings of the Technology Transfer Workshop, Environmental Impact Assessment in the North, Oct 31, Nov 1-2, 1978. Inland Waters Directorate, Ottawa,l Ontario, Canda, Technical Workshkop Series No 1, p 10-11, 109-120, 1979. 43 Ref.

Descriptors: *Environmental impact assessment, *Arctic, *Northern development, *Environmental effects, Watersheds, Hydrologic properties, Morphology, Drainage, *Sediment transport, Sediment yield, Equations, Precipitation, Runoff, Morphometric analysis, Glaciation, Canada.

In regions of very little precise data on streamflow and sediment regimes, study of basin properties has relevance for comparative studies within or between regions, the basin properties especially reievant to arctic hydrology are basin aspect, relief, relief distribution, drainage density, drainage area, area of lakes and glacial history. Morphology is also used to prepare prediction equations. A sediment yield equation based on morphologic parameters is presented which appears to have merit for preliminary evaluation of regional sediment transport rates. A description and reason for examining each of these points is discussed. Finally, it is noted that Arctic basins have a number of features in common with urban and semi-arid basins. A review of available models might provide useful data to northern programs. (WATDOC)
W81-00459

2K. Chemical Processes

THE EFFECT OF NITRATE ON NITROUS OXIDE REDUCTION IN ORGANIC SOILS AND SEDIMENTS,
Agricultural Research and Education Center, Belle Glade, FL.
R. E. Terry, and R. L. Tate, III.
Soil Science Society of America Journal, Vol 44, No 4, p 744-746, July-August 1980. 3 Tab, 12 Ref. OWRT-B-041-FLA(1), 14-34-0001-9063.

Descriptors: *Saturated soils, *Denitrification, *Nitrogen cycle, *Organic soils, Soil chemistry, Nitrates, Soil science, Oxides, Sediments, Analytical techniques, Testing procedures, Analysis, Data collections, Chemical reactions, Chemical analysis, Histosols.

Inhibition of N20 reduction by NO3(-) in cultivated Pahokee muck was determined by measuring N20 accumulation in soil samples incubated in the presence and absence of acetylene. At NO3(-)-N levels of 40 mg/liter or greater, nearly 100% of the gaseous denitrification products were N20 in Pahokee muck. Reduction of the accumulated N20 proceeded rapidly after the NO3(-) was exhausted from the soil. In comparison, N20 was readily reduced in ditch sediment samples in the presence of comparable concentrations of NO3(-). With NO3(-)-N concentrations in the ditch sediments ranging from 90 to 39 mg/liter, less than 10% of the gaseous denitrification products were N20. Similarly, NO3(-) levels in soil samples from a vegetable field which had been flooded 22 days had negligible effect on N20 reduction. These data demonstrate that the inhibitory effect of NO3(-) on N20 reduction was less in sediments and in organic soils that had been subjected to prolonged flooding than in the cultivated soils. (Humphreys-ISWS)
W81-00311

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

METHOD FOR BRINGING NUTRIENT-RICH WATER FROM THE APHOTIC ZONE OF THE OCEAN TO THE PHOTIC ZONE,
W. T. Finley.
U.S. Patent No 4,189,379, 4 p, 1 Fig, 13 Ref; Official Gazette of the United States Patent Office, Vol 991, No 3, p 988-989, February 19, 1980.

Descriptors: *Patents, *Desalination, *Nutrients, *Water treatment, Oceans, Aphotic zone, Euphotic zone, Electrodialysis, Movement, Conduits.

Nutrient-rich ocean water from the aphotic zone of the ocean, which normally begins at about 100 to 200 meters below the ocean surface, is desalinated or partially desalinated in situ using electrodialysis to leave the nutrients in the water. The nutrient-rich desalinated water thus obtained, being of lesser density than the surrounding seawater, naturally rises through conduits into the relatively nutrient-poor photic zone of the ocean and is dispersed therein, thus increasing the concentration of nutrients in the photic zone near the surface of the ocean. This increases the fertility of the near-surface photic zone, and thus increases the supply of harvestable food fish from the near-surface photic zone. (Sinha-OEIS)
W81-00367

3C. Use Of Water Of Impaired Quality

SALINE WATER UTILIZATION - AN INTERNATIONAL PERSPECTIVE,
New Mexico State Univ., Las Cruces.
G. O'Conner.
In: A Quarter Century of Water Research. Proceedings of the Twenty-Fifth Annual New Mexico Water Conference. Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 68-77. New Mexico Resources Research Institute, New Mexico State University, Box 3167 Las Cruces, NM 88003 2 Tab, 9 Ref.

Descriptors: *New Mexico, *Saline water, *Irrigation practices, *Plant breeding, *Crop production, *Halophytes, Sodium, Soil structure, Agricultural engineering, Soil management, Agronomy.

Saline water utilization has tremendous potential in New Mexico and throughout the world. Some early research in Israel utilized very saline groundwater to grow non-halophytic trees and conventional crops, such as sugar beets and barley. In 1977, tomatoes and barley were grown in New Mexico's sand dunes with Pacific Ocean water. Current research approachs to test saline water utilization include using naturally occurring halophytic (salt-tolerant) species to supplement traditional crops, breeding and/or selecting for salt tolerance and substituting saline water for fresh water. Using saline irrigation water can require different management techniques such as, high frequency trickle irrigation, soil amendments (gypsum), increased leaching, and using more salt-tolerant crops. Saline-water utilization may not be feasible for all agricultural settings. Long-term studies of 3 to 5 years are needed. The critical element determining the quality of saline water is the level of total dissolved solids (TSD). (Atkins-Onmiplan)
W81-00395

3D. Conservation In Domestic and Municipal Use

MAKE SEWAGE A VALUABLE COMMODITY,
Westminster, CO.
B. Christopher.
American City and County, Vol 95, No 7, p 47-48, July, 1980. 1 Fig.

Descriptors: *Irrigation practices, *Farms, *Sewage sludge, *Water reuse, *Return flow, Sewage, Waste water disposal, Sewage effluents, Waste water treatment, Sludge disposal, Liquid wastes, Injection wells, Fertilizers, Sewage treatment, Water conservation, Ultimate disposal, Pumping plants.

The city of Westminster, Colorado, in a project 75% funded by EPA, is cooperating with farmers downstream to reuse existing water resources and to make use of waste water effluent. The city's secondary sewage effluent is exchanged for an equal amount of the farmer's irrigation water. Since June 1978, the pumping station at the 2.25 mgd city waste water treatment plant has been pumping 5 acre ft/day effluent to farmers (average daily city water use = 23.63 acre ft). The total water exchanged during the 2-yr program has been 1,206 acre ft. By June 1982, the waste water treatment plant's capacity will have been expanded to 5.0 mgd, and the program will have the potential to provide the city with approximately 2,000 acre ft/yr of exchanged water, enough to support an estimated 6,000 single family dwelling units. Water quality is tested daily, and water tested in August 1977 and August 1978 showed no change in quality. Westminster plans to build a reservoir in which to store its winter effluent until the farmers need it in spring. The second aspect of the reuse plan consists of injecting all the city's liquid sludge from the treatment plant into cultivated farm land, a process more efficient than spreading because it eliminates loss through evaporation of about 70% of the sludge ammonia values. One farmer found that 16 acres of sludge-treated soil produced 19.2 tons/acre of corn compared with 17.6 tons/acre for 16 acres of untreated soil. (Gish-FRC)
W81-00258

WATER CONSERVATION ALTERNATIVES FOR THE NORTH,
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
J. J. Cameron, and B. C. Armstrong.
Economic and Technical Report EPS 3-WP-80-2, 1980. 45p, 5 Fig, 10 Tab, 32 Ref.

Descriptors: *Water conservation, *Wastewater reuse, Public services, Water requirements, *Cost-benefit analysis, Economics, Northwest Territories, *Canada, Pricing, Plumbing codes.

This report reviews water use characteristics, pricing policies, plumbing codes, public acceptance, water conservation experiences, and the methods and technology to reduce water use and the concomitant energy requirements. Various administrative alternatives and water conservation technology for toilets, bathing, laundry, kitchen and households are analyzed with respect to appropriateness, public acceptance and cost-effectiveness. Economic analyses and water conservation strategies for both trucked and piped utility systems are presented. Trucked systems are preferred in communities with limited water supplies, and very low water use fixtures such as recirculating toilets, self-closing hand-held shower units and spray faucets are recommended. If a central laundry facility is installed, household water requirements can be reduced to only 13 litres per person per day. A final recommendation is made for a water conservation demonstration project to monitor retrofit and new installation for both the piped and trucked systems. (WATDOC)
W81-00384

3E. Conservation In Industry

THE IMPACT OF ENERGY DEVELOPMENT ON WATER RESOURCES,
New Mexico Energy and Minerals Dept., Santa Fe.
L. Kehoe.
In: A Quarter Century of Water Research. Proceedings of the Twenty-Fifth Annual New Mexico Water Conference. Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 160-174, New Mexico Resources Research Institute, New Mexico State University, Box 3167 Las Cruces, NM 88003.

Descriptors: *Synthetic fuels, *New Mexico, *Water utilization, *Natural resources, *Coal, *Energy development, Oil shale, Legislation, Research and development, Energy conversion, Surveys, Biomass, Fossil fuels, Natural gas, Water allocation.

An overview of President Carter's synthetic fuels program, its relation to water usage and the availablility of natural resources in New Mexico is presented. The $80 billion synfuels program is expected to produce the equivalent of 2.5 million barrels of oil a day from coal liquefaction, coal gasification, oil shale biomass and unconventional gas. The reports supporting this replacement of oil do not include information on the water usage that will be involved. Figures are shown comparing projected U.S. synfuels production in 1985 and in 1980 using low-, medium-, and high-effort scenarios. A seven-fold increase is expected during this time using a 'crash program.' A second figure shows the relative magnitude of production by various sources of synfuels with almost one-half of the total goal expected to come from coal liquids and gases. New Mexico's fossil fuel supply, over three-quarters coal, may play a significant role in that production. These new fuel sources will require more water than current energy sources. The amount of water tp produce 1 quad BTU for seven traditional and proposed fuel sources is depicted. Production of high BTU coal gasification requies nearly fifteen times as much water as the present technology to produce natural gas. Public attitude surveys regarding water, its applications, and energy resources and development as related to the total social and economic structure in New Mexico are discussed. (Vernale-Omniplan)
W81-00397

3F. Conservation In Agriculture

MAKE SEWAGE A VALUABLE COMMODITY,
Westminster, CO.
For primary bibliographic entry see Field 3D.
W81-00258

A REGIONAL EVALUATION OF OFF-SEASON AGRICULTURAL USE OF WATER AND ENERGY RESOURCES,
South Dakota State Univ., Brookings. Water Resources Inst.
M. L. Horton, C. G. Carlson, R. E. Beyer, L. R. Stone, and R. E. Gwin, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127342, Price codes: A05 in paper copy, A01 in microfiche. Completion Report, October, 1980. 89 p, 36 Fig, 44 Tab, 41 Ref. OWRT-B-052-SDAK(1), 14-34-0001-7187.

Descriptors: *Irrigation practices, *Supplemental irrigation, *Irrigation effects, *Evaluation, *Crop production, Irrigation, Experimental farms, Montana, Kansas, South Dakota, Irrigation water, Irrigation systems, Water utilization, Winter, Excess water(Soils), Autumn, Wheat, Alfalfa, Assessments, Crop response.

The underlying assumption for off-season irrigation has been that irrigation up to field capacity during the low evaporative demand seasons, Fall, early/late Winter, and early Spring, would represent an efficient use of irrigation water. The major question analyzed in this study was: would off-season irrigation be a practical and workable practice. The study was carried out by three independent research groups in Montana, Kansas, and South Dakota, and the three reports were separately presented. For South Dakota, the winter wheat crop did not appear to have increased winter survivability from fall irrigation, and weeds appeared much less manageable. If Fall irrigation is to be practiced, one-half the available soil moisture content should be the upper limits of off-season profile filling. For Montana, the second cutting in the Fall of 1979 was the only significantly different alfalfa

yield. Poor efficiencies were noted for Fall irrigations, with an apparent decrease in Fall-applied water carryover when the profile is filled above half of its water holding capacity. For Kansas it was concluded that Fall irrigation increasing the profile soil water content above 18 inches would be relatively inefficient in providing water for the next summer's crop. (Zielinski-IPA)
W81-00314

DRIP IRRIGATION SYSTEM,
Vernay Labs., Inc., Yellow Springs, OH. (Assignee).
G. E. Atkinson, and K. C. Tregillus.
U.S. Patent No 4,190,206, 5 p, 11 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 991, No 4, p 1267, February 26, 1980.

Descriptors: *Patents, *Irrigation systems, *Application equipment, *Flow control, Irrigation efficiency, Irrigation operation and maintenance, Drip irrigation.

A drip irrigation system includes a flow control valve having an inlet opening which constricts in response to pressure increases to provide a uniform flow dispite pressure variations. The inlet opening of the valve has a rectangularly cross-sectioned central section and end sections which are non-rectangular, such as triangular or semi-circular, in cross section. During normal flow conditions the rectangular central section of the inlet opening is pressed closed and irrigation liquid flows at a constant rate through the two end sections. (Sinha-OEIS)
W81-00368

SELF-CORRECTING LINEARLY MOVABLE IRRIGATION SYSTEM,
Gifford-Hill and Co., Inc., Tulsa, OK. (Assignee).
G. A. Beusch, H. L. Thompson, H. E. Lindner, and G. G. Jones.
U.S. Patent No 4,190,068, 16 p, 7 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 991, No 4, p 1219, February 26, 1980.

Descriptors: *Patents, *Irrigation systems, *Sprinkler irrigation, *Application equipment, Lateral conveyence structures, Irrigation efficiency, Irrigation operation and maintenance.

A linearly movable irrigation system includes interconnected power driven irrigation spans supporting a water supply conduit, whose sections are capable of moving over a land area and depositing a controlled amount of water. At one extremity of the irrigation system a steerable and powered mover unit is provided that accepts water from a water supply system and conducts it to the overhead irrigation pipe under sufficient pressure to cause proper distribution of water through sprinkler devices located along the length of the irrigation conduit. A power driven pump is supported by the steerable mover unit in order to pressurize or provide boosting pressure for the water. The steerable mover unit is adapted to move in proximity to an elongated reference which may be straight or curved as desired. The unit is provided with means for sensing stresses and angular relationship of the irrigation spans relative to the mover unit for providing control signals to the irrigation system that maintain stresses and angular misalignment of the system within an acceptable range. Each extremity of the irrigation system may move at different average speeds which are determined by the control signals for corrective relative movement. The extremities of the irrigation system may also move simultaneously at equal speeds or at different speeds to accomplish controlled movement during irrigation operations. (Sinha-OEIS)
W81-00369

SIMPLIFIED IRRIGATION CONTROLLER,
Toro Co., Riverside, CA. (Assignee).
T. L. Kendall.
U.U. Patent No 4,189,776, 16 p, 9 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 991, No 3, p 1103, February 19, 1980.

Descriptors: *Patents, *Irrigation systems, *Control systems, Automatic control, Scheduling, Electronic equipment, Instrumentation, Irrigation efficiency.

The invention discloses a simplified solid state controller for use in controlling automatic irrigation systems. The operator input panel provides no means for the inputting of numerical irrigation information such as station start times and station run times. Rather, the input panel provides switch means whereby the operator can initiate a number of parameterization logic sequences where the current information data in memory is displayed to the operator. Through the input panel, the operator can cause the information displayed to be advanced to a new desired value an a step-by-step basis. Upon the displayed value being equal to the value desired as the new value by the operator, the operator signals to the logic of the controller through the input panel and the current value is updated to the presently displayed value. (Sinha-OEIS)
W81-00370

IMPORTANCE OF CROP PRODUCTION FUNCTIONS IN EVALUATING CONSUMPTIVE USE OF WATER,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Engineering.
E. G. Hanson, and T. W. Sammis.
In: A Quater Century of Water Research. Proceedings of the Twenty-Fifth Annual New Mexico Water Conference. Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 36-58. New Mexico Resources Research Institute, New Mexico State University, Box 3167 Las Cruces, NM 88003 14 Fig, 1 Tab, 13 Ref.

Descriptors: *New Mexico, *Crop production, *Irrigation, *Evapotranspiration, *Crop production functions, *Consumptive use, *Soil moisture, Grain crops, Lysimeters, Irrigation effects, Crop response, Plant growth, Field crops.

Determining consumptive use, also called evapotranspiration (ET), of selected crops and relating ET data to crop yield is required for many purposes. These include planning efficient irrigation systems, determining irrigation requirements and equitable water rights, and evaluating the life expectancy of water supply in underground basins. Normal consumptive use is the ET rate that occurs when crops produce average yields and may be determined by plotting the average yields on crop-production functions. Alfalfa, grain corn, cotton, chile and grain sorghum were grown at selected locations throughout New Mexico during 1976, 1977 and 1978. The Et rate was measured with a non-weighing type lysimeter and water balance technique. Yield was measured from the lysimeter and adjacent field at harvest time. Neutron access tubes installed in the lysimeters measured weekly changes in soil moisture every 15 cm of depth. Water applied by sprinkler-line source was measured with catchment cans. These data and data from other irrigation projects were used to derive crop-production function for each crops, excluding chile. Crop-production functions having high coefficients of determination appear to be a better method of estimating the normal ET required in an area. A more direct correlation was found between ET and alfalfa yield than for ET and grain crop yields. Variables that cause a reduction in ET may cause a corresponding reduction in crop yield. These variables include water stress, solar radiation, temperature, management, insects, grazing and increased soil salinity. (Vernale-Omniplan)
W81-00393

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

STORMWATER MANAGEMENT IN THE UNITED STATES A STUDY OF INSTITUTIONAL PROBLEMS, SOLUTIONS AND IMPACTS,
Stormwater Consultants, Bolingbrook, IL.
H. G. Poertner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121048, Price codes: A11 in paper copy, A01 in microfiche. Report, September 1980, 240 p, 6 Fig, 12 Tab, 5 Append. OWRT-C-5239(No 4235)(1), 14-31-0001-4235.

Descriptors: *Administration, *Management, *Urban drainage, *Storm water, *Institutional constraints, Local governments, Runoff, Storm runoff, Urban runoff, Financial feasibility.

Personal interviews were conducted in many urban and metropolitan areas of the United States to investigate institutional problems in stormwater management. Successful solutions and the impacts and transferability of solutions were studied in detail. The objective was to prepare a report useful to local public officials and management personnel in developing and operating effective, economical and timely programs and facilities for managing stormwater. Extensive case studies were made of: Cook County, Illinois; Metropolitan Denver, Colorado; Fairfax County, Virginia; and the City and County of Tulsa, Oklahoma. The studies addressed the broad field of stormwater management, including both 'control' and 'developmental' activities. The institutional problems investigated were those that typically arise in creating, supporting and operating local stormwater management organizations and programs. Also studied were the institutional problems associated with implementation activities, including: planning, engineering, constructing, operating and maintaining physical facilities. These various problems are characterized in the report as: financial, administrative, organizational, jurisdictional, legislative, legal, political, social, economic, environmental, ecological, planning, public education and communication. Findings of the study and the author's conclusions and recommendations are given in the first chapter.
W81-00263

PERFORMANCE AND EFFECTS OF SCS FLOODWATER RETARDING STRUCTURES IN THE 1979 EASTER FLOODS,
Soil Conservation Service, Jackson, MS.
P. Forsythe, and R. Ulmer.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 61-63, (1979) 2 Fig.

Descriptors: *Mississippi, *Flood control, *Flood drainage, *Farm ponds, Dams, Spillways, Scour, Erosion, Channels, Soil Conservation Service, Cow paths, Impoundments, Overflow, Flood flow, Spillway crests.

The performance of the floodwater retarding structures and farm ponds in the Pearl River Basin during the 20 + inch rainfall of April 12-13, 1979 was excellent. In general, failures occurred where proper design and maintenance were not provided. Ninety-nine percent of the farm ponds performed as designed without failure. The storm was massive, 2.4 times the 100 year-24 hr rainfall and 69% of 6 hr PMP. The Soil Conservation Service floodwater retarding structures are not designed for so large a storm but they performed well with only minor damage. Turbulence and scouring occurred in and beyond some emergency spillways due to fences and cow paths. Hop and skip flow conditions initiated by surface irregularities caused minor damages in the $1,000 to $5,000 range. Some farm pond failures can be attributed to debris plugged screens across spillways. Much more damage and inundation of urban areas would have occurred without the successful performance of the retarding structures. (See also W81-00290) (Seigler-IPA)
W81-00302

GREEN RIVER BASIN FLOW FORECASTING MODELS,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
P. G. Katz, and G. H. Toebes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124448.

Price codes: A10 in paper copy, A01 in microfiche. Technical Report No 136, October 1980. 193 p, 56 Fig, 53 Tab, 17 Ref, 4 Append. OWRT B-094-IND(4).

Descriptors: *Streamflow forecasting, *Model studies, *Kentucky, *Reservoir operation, Reservoir releases, Reservoir storage, River forecasting, Flow nets, Reservoirs, *Green River Basin(KY).

River flow-watershed runoff models of the Green River Basin in Kentucky are needed for the efficient operation of the basin's reservoirs. Correlative linear models that relate reach outflow to reach inflows and to precipitation over the side-inflow contributing watersheds offer a relatively simple, easy to use method of satisfying the requirements. Difference models were constructed for the 9 river reaches into which the Green River System had been divided previously. Submodels and the basin model made by linking the submodels together were found to perform better than the linear models constructed earlier. Premultiplication of the precipitation by the average monthly runoff coefficient prior to the model identification phase was found to improve the forecasting accuracy of the resulting difference model. Problems which may be encountered in using the difference model with premultiplication of precipitation by the average monthly runoff coefficient for real-time forecasting were considered. In conjunction with this the manual flow forecasting methods used by Louisville District of the Corps of Engineers were examined. An automated procedure, called 'Computed Hydrograph Adjustment Technique' (CHAT) was shown to offer a potential for further model improvement.
W81-00329

WINTER WATER--THE FLOODING AT BOISE, IDAHO, JANUARY 11-12, 1979,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 2E.
W81-00364

4B. Groundwater Management

GROUND WATER MINING AND WESTERN WATER RIGHTS LAW: THE NEBRASKA EXPERIENCE,
Nebraska Univ., Lincoln.
For primary bibliographic entry see Field 6E.
W81-00269

AREAS OF NATURAL RECHARGE TO THE FLORIDAN AQUIFER IN FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. W. Stewart.
Florida Bureau of Geology Map Series 98, 1980. 1 Sheet, 4 Fig, 11 Ref.

Descriptors: *Maps, *Natural recharge, *Aquifers, *Groundwater, *Florida, Aquifer characteristics, Surface waters, Potentiometric level, Water wells, Withdrawal, Water table, Pumping, Artificial recharge, Water quality, Water supply, Hydrogeology, *Floridan aquifer.

The Floridan aquifer, the most extensive and widely used aquifer system in Florida, consists chiefly of limestone and dolomite. The aqifer is at or near land surface in northwest and north-central Florida and about 1,000 feet below land surface in northwest and south Florida. It is overlain by surficial materials ranging in thickness from a few feet to several hundred feet, including water-bearing sands. Water is unconfined in the surficial aquifer and confined in the Floridan aquifer. Three types of classifications are used to delineate the relative effectiveness of natural recharge areas of the Floridan aquifer: least effective, moderately effective, and most effective. The least effective recharge areas are areas of artesian flow where the potentiometric surface of the Floridan aquifer is above land surface and recharge of the aquifer can not occur under natural conditions. About 50 percent of the State falls within this classification. The moderately effective recharge areas represent about 35 percent of the State and recharge rates are estimated to range from less than 1 to 10 inches per year. The most effective areas represent about 15 percent of the State and recharge rates range from about 10 to 20 inches per year. (USGS)
W81-00345

THE SURFICIAL AQUIFER AT THE U.S. NAVAL STATION NEAR MAYPORT, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-00349

EVALUATION OF A CAVITY-RIDDLED ZONE OF THE SHALLOW AQUIFER NEAR RIVIERA BEACH, PALM BEACH COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. N. Fischer, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-115776, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-60, 1980. 39 p, 13 Fig, 7 Tab, 13 Ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Water quality, *Water yield, *Florida, Hydrogeology, Water supply, Saline water intrusion, Water pollution sources, Water wells, Water analysis, Evaluation, *Palm Beach County(FL), *Riviera Beach(FL).

The shallow aquifer near Riviera Beach, Palm Beach County, Fla., contains a cavity-riddled zone extending north and south about 5 miles inland from the Atlantic Ocean. The zone lies at approximately 60 feet below land surface and varies from 15 to 50 feet in thickness. It is approximately 3 miles in width. Aquifer material is calcareous quartz sand-stone in the cavity zone, whereas the remainder of the consolidated aquifer material is primarily limestone. The zone is overlain by several thin clay beds which provide varying degrees of confinement. The transmissivity of the cavity-riddled zone of the aquifer in the area of investigation is approximately 11,000 square feet per day. Preliminary evaluation indicates that large volumes of water of suitable quality for public supply can be developed from the zone, except in an area adjacent to a landfill where leachate has adversely affected water quality. (USGS)
W81-00351

4C. Effects On Water Of Man's Non-Water Activities

TWO APPROACHES TO IDENTIFY STORM WATER RUNOFF LOADS,
Geological Survey, NSTL Station, MS. Gulf Coast Hydroscience Center.
W. H. Doyle, and M. E. Jennings.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 101-106, (1979) 8 Fig, 5 Ref.

Descriptors: *Miami, Florida, *Houston, Texas, *Storm runoff, *Urban runoff, Water pollution sources, Sampling, Overland flow, Monitoring, Model studies, Computer models, Computer programs, Hydrologic data, Land use, Rainfall-runoff relationships.

Houston, Texas, and Miami, Florida, were the sites for two urban stormwater studies comparing a coarse modeling technique and an intense data collection modeling technique. In Houston the rapidly urbanizing Buffalo Bayou basin encompassing 975 sq mi was used. A broad-scale model, STORM (storage, treatment, overflow, and runoff), was used. It was calibrated for each of eight watersheds and five land use characteristics. Results show that annual storm-runoff loads ranged from 43 to 97% of total basin load. The Houston study illustrated the successful application of the broad-scale identification approach. The Miami study used a comprehensive data collection network to identify urban pollutant sources by sampling in small catchments of similar land use. An automated monitoring system was used to record rainfall and stage data and to activate the water sampling equipment. A data management system was developed to process the masses of data. Provided that funding and manpower are available this intensive approach can be successfully used to identify pollutants by land-use type. (See also W81-00290) (Seigler-IPA)
W81-00310

SUSPENDED-SEDIMENT DISCHARGE, IN FIVE STREAMS NEAR HARRISBURG, PENNSYLVANIA, BEFORE, DURING, AND AFTER HIGHWAY CONSTRUCTION,
Geological Survey, Harrisburg, PA. Water Resources Div.
L. A. Reed.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $2.25. Geological Survey Water-Supply Paper 2072, 1980. 37 p, 17 Fig, 8 Tab, 10 Ref.

Descriptors: *Sediment transport, *Sediment discharge, *Stream, *Road construction, *Pennsylania, Sediment load, Particle size, Streamflow, Turbidity, Rainfall-runoff relationships, Farm ponds, Tap efficiency, Erosion control, Sediment control, Basic data collections, *Harrisburg(PA), Pre-construction data, Cost-construction data.

Rainfall, streamflow, sediment, and turbidity data were collected as part of a study to evaluate the effects of highway construction on suspended-sediment discharges in stream near Harrisburg, PA. The study was also designed to evaluate the effectiveness of different erosion-control measures in reducing sediment discharge. Although highway construction increased suspended-sediment discharges from two to four-fold, the rate of sediment discharge quickly returned to pre-construction levels when construction ended. The most effective sediment control evaluated was offstream ponds, which were designed to trap and store sediment laden water from the construction area. The offstream ponds trapped about 70 perent of the sediment that reached them during most storms. Seeding and mulching generally reduced sediment loads about 20 percent. Rock dams and bales reduced loads about 5 percent. An onstream pond, constructed on a large stream below the construction area, reduced sediment loads about 80 percent. However, unlike the offstream ponds, which stopped discharging runoff water soon after precipitation ended, the onstream pond kept discharging runoff water, and the stream below the pond remained turbid for extend periods. (USGS)
W81-00361

4D. Watershed Protection

USE OF BOUNDING WELLS TO NEGATE THE EFFECTS OF GRAVITY AND PRE-EXISTING GROUNDWATER MOVEMENT IN DIPPING AQUIFERS USED FOR STORAGE,
Louisiana State Univ., Baton Rouge. Dept. of Petroleum Engineering.
P. J. Abadie.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124554, Price codes: A06 in paper copy, A01 in microfiche. Master of Science Thesis, August, 1979. 100 p, 8 Fig, 2 Tab, 16 Ref, 2 Append. OWRT-A-044-LA(2).

Descriptors: *Wells, *Aquifer management, *Laboratory equipment, *Mathematicat models, *Groundwater movement, *Gravity, *Underground storage, *Water loss, *Water conservation, Groundwater, Percolation, Water management(Applied), Water measurement, Flow measurement, Water, Injection wells, Water storage, Freshwater, Gradients(Streams), Mathematical studies.

Fresh water stored in a dipping saline aquifer results in the imigration of the bubble of injected water away from the injection/production well

due to pre-existing groundwater movement and gravity, possibly rendering a storage project economically useless due to low recovery of the injected fresh water. Bounding wells partially offset the deleterious effects of pre-existing flow and gravity. A computational procedure was developed for predicting the bounding well rates needed to negate the combined effects of pre-existing flow and gravity, and was verified using a laboratory size miniature aquifer. Efficacy of the bounding well systems studied was quantified by measuring recovery efficiencies (fraction of fluid recovered). Pre-existing flow and gravity tended to cause the injected fluid to migrate downdip in all runs. The injected fluid volume and the injection/production rate was the same for all runs. With a dip angle of 30 degrees, a density difference of 0.0163 g/cc and a pre-existing gradient of 0.05 psi/ft, recovery efficiency was 51.7% with no bounding wells; and 95.3% operating the bounding wells at the computed rates for this system. At a density difference of 0.55 g/cc, recovery efficiency was 33.6% and 20.9% with and without bounding wells. (Zielinski-IPA)
W81-00312

SUSPENDED-SEDIMENT DISCHARGE, IN FIVE STREAMS NEAR HARRISBURG, PENNSYLVANIA, BEFORE, DURING, AND AFTER HIGHWAY CONSTRUCTION,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 4C.
W81-00361

CONSERVATION IMPACTS AND PRACTICES OF SAND REMOVAL FROM DRY BED OKLAHOMA RIVERS,
Oklahoma State Univ., Stillwater.
For primary bibliographic entry see Field 2J.
W81-00380

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

DIRECT DETERMINATION OF LEAD IN POLLUTED SEA WATER BY CARBON-FURNACE ATOMIC ABSORPTION SPECTROMETRY,
Napier Coll. of Commerce and Technology, Edinburgh (Scotland). Dept. of Biological Sciences.
M. C. Halliday, C. Houghton, and J. M. Ottaway.
Analytica Chimica Acta, Vol 119, No 1, p 67-74, September 1, 1980. 4 Tab, 24 Ref.

Descriptors: *Lead, *Sea water, *Spectrometers, *Analytical techniques, *Water sampling, Water pollution, Trace elements, Pollutant identification, Ammonium compounds, Instrumentation, Filtration, Salts, Dissolved compounds, Testing procedures, Water analysis, Chemical analysis.

A Perkins-Elmer 373 atomic absorption spectrometer equipped with a heated graphite atomizer HGA 2200 was used for the direct determination of lead in polluted sea water. The water was obtained from the outer Firth of Forth, filtered, then diluted (1 + 1) with deionized distilled water and ammonium nitrate (as a matrix modifier). Aliquots were injected into the furnace, which was equipped with a tantalum-coated graphite tube, under gas-stop conditions. The matrix modifier and the tube coating reduced the suppressive effects on the signal of salts present in the water to such a degree that the quantity of lead could be determined by the method of standard additions. When the sea water was not filtered prior to analysis, the variability in results was excessive. However, the results obtained by carbon-furnace atomic absorption spectrometry correlated significantly with those obtained by anodic stripping voltammetry ($r = 0.84$, $p < 0.01$) and were not significantly different according to the paired t test ($t = 0.93$). A marked improvement in reproducibility was achieved by filtration of the water, yielding a detection limit of 1 microgram Pb/liter. The method described allows the rapid screening of a large number of samples (approximately 50/day) with minimal effort if an automatic sampling device is used. (Gish-FRC)
W81-00253

FATE OF COLIFORM BACTERIA IN THE UPPER NEW YORK BAY,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
M. S. Finstein, and M. L. Morris.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-126534, Price codes: A03 in paper copy, A01 in microfiche. Final Report, October 1980. 4 p, 1 Fig, 11 Tab, 35 Ref. OWRT-A-049-MJ(1), 14-34-0001-8032.

Descriptors: *New York Bay, *Sewage effluents, *Coliforms, *Sewage bacteria, E. coli, Enteric bacteria, Water pollution sources, Microbiology, Waste water treatment, Chlorination, Water sampling, Environmental effects, New Jersey.

Quantitative and qualitative analyses were made of the coliforms in both the primary treated effluent and the receiving waters (New York Bay) of the Passaic Valley Sewerage Commissioners (PVSC) treatment plant. The membrane procedure was used to determine standard coliform counts and colonies were identified with the API 20E enteric identification system which consists of a battery of 23 biochemical tests. Treatment at the PVSC plant consists of primary sedimentation and, in season, chlorination. Water samples were taken at 11 stations in the Bay with a Kemmerer bottle. Sediment samples were taken with an Eckman dredge and were diluted with a phosphate buffer solution. The standard coliform count of the effluent was 100,000 to 5,000,000/ml. In order of abundance the major coliforms were: Klebsiella pneumoniae, Enterobacter cloacae, Citrobacter freundii, and Escherichia coli. In the Bay near the discharge field, the coliform count ranged from 210 to 740/ml. Leading contributors were: Enterobacter cloacae, Klebsiella pneumoniae, Citrobacter freundii, Escherichia coli, and Aeromonas hydrophila. Laboratory studies showed that the addition of effluent slow the disappearance of three of the coliforms from Bay water. (Seigler-IPA)
W81-00324

SOLUBILITIES OF PHENOL AND CHLORINATED PHENOLS IN SUPERCRITICAL CARBON DIOXIDE,
Delaware Univ., Newark. Dept. of Chemical Engineering.
R. Van Leer, A. Van Leer, and M. E. Paulaitis.
Journal of Chemical and Engineering Data, Vol 25, No 3, p 257-259, July 1980. 3 Fig, 3 Tab, 5 Ref. OWRT-A-045-DEL(2).

Descriptors: *Chlorine, *Carbon dioxide, *Phenols, *Solubility, Solvents, Solutes, Chemical precipitation, Saturation, Chemical properties, High pressure, Liquids, Waste water(Pollution), Columns.

The solubilities of three common waste water pollutants, phenol, p-chlorophenol, and 2,4-dichlorophenol, were measured in supercritical carbon dioxide as a function of pressure. Measurements were made at 36C over a range of 80 to 250 atmospheres. Phenol was also tested at 60C over the same range of pressures. For the testing liquid carbon dioxide at ambient temperature was charged into a Milton Roy high-pressure liquid pump to produce the desired pressures. The pump continuously delivered solvent at flow rates from 60 to 300 standard cu cm/min. The solvent was fed into two high-pressure equilibrium cells connected in series. The cells were columns packed with glass beads and the heavy solute. After leaving the cells the saturated solution was flashed to atmospheric pressure and the heavy component was collected in a cold trap to be measured with a wet-test meter. Results are given as tables and as plots. At 36C the solubility of phenol is similar to that of other solid-super critical fluid systems. At 36C the isotherms for p-chlorophenol and 2,4-dichlorophenol are characteristic of liquid-supercritical fluid systems. The results indicate that the solubilities in supercritical carbon dioxide increase as the number of chlorine groups on the solute increase, probably due to the decreased bonding in the condensed phase. (Seigler-IPA)
W81-00340

IDENTIFICATION AND CONFIRMATION OF ATRAZINE IN POND WATER,
Colorado State Univ., Fort Collins. Inst. of Rural Environmental Health.
M. J. Aaronson, K. W. Kirby, and J. D. Tessari.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 492-497, September, 1980. 4 Fig, 1 Tab, 3 Ref.

Descriptors: *Triazine pesticides, *Farm ponds, *Fishkill, *Organophosphorus pesticides, Pesticides, Atrazine, Cyanazine, Gas chromatography, Mass spectrometry, Ponds, Farms, Degradation(Decomposition), Aquatic environment, Ecosystems, Thiocarbamate pesticides, Pollutant identification.

Large fishkills in a farm pond were attributed to atrazine, although the surrounding farmland showed recent applications of only Bladex (cyanazine), Counter (an organophosphate), and Sutan (a thiocarbamate). Pond water samples were extracted into methylene chloride. The latter two compounds were unidentifiable upon gas chromatographic/mass spectrometric analyses of extracts. The presence of atrazine in the pond water was positively confirmed, but its origin remained unknown. Private reports stated that cyanazine in soil would undergo degradation of the nitrile to form an amide which would convert to the acid with subsequent decarboxylation. From this process, atrazine would derive from cyanazine. Other experiments have shown that atrazine remained in the physical and biological components of pond water following a period of 2 yr after application. The possibility of atrazine entering the aquatic ecosystem after land application appears to be very high. (Geiger-FRC)
W81-00412

PRIORITY POLLUTANT ANALYSES OF INDUSTRIAL WASTEWATERS USING A MICROEXTRACTION APPROACH,
Southwest Research Inst., San Antonio, TX. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 7B.
W81-00445

EXPERIMENTAL APPLICATION OF GAS CHROMATOGRAPHIC HEADSPACE ANALYSIS TO PRIORITY POLLUTANTS,
Greenwood Lab., Kennett Square.
For primary bibliographic entry see Field 7B.
W81-00446

ESTIMATED APPLICATION OF GAS CHROMATOGRAPHIC HEADSPACE ANALYSIS TO PRIORITY POLLUTANTS,
Catalytic, Inc., Philadelphia, PA. Environmental Systems Div.
For primary bibliographic entry see Field 7B.
W81-00447

APPLICATION OF CURRENT METHODS FOR METALS DETERMINATION IN WASTEWATERS FROM THE ORGANICS/PLASTICS INDUSTRY,
Gulf South Research Inst., New Orleans, LA.
C. S. Monteith, and J. E. Gebhart.
Journal of Environmental Science and Health (A), Vol 15, No 5, Special Issue, p 503-511, 1980. 2 Tab, 3 Ref.

Descriptors: *Heavy metals, *Spectrophotometry, *Water analysis, *Organic wastes, Water pollution, Trace elements, Effluent streams, Industrial wastes, Digestion, Chemical wastes, Pollutant identification, Analytical techniques, Laboratory tests.

Aqueous samples taken from various process and effluent streams of organic and plastic chemical

industries were analyzed for 13 trace elements from the EPA list of priority pollutants by three laboratories using atomic absorption spectrophotometry. Cadmium, chromium, copper, lead, antimony, arsenic, beryllium, mercury, nickel, selenium, silver, thallium, and zinc were the elements determined. Sample preparation differed slightly in each laboratory. In two of the three laboratories, metal species which were recoverable in hot nitric acid, namely metals in the ionic state, were determined. The other laboratory used digestion methods to recover 'total' metals, meaning metals in the covalently bound state and in the ionic state. More rigorous digestion conditions were needed for recovery of covalently bound metals, so that a greater portion of the spike was lost than when using the digestion procedure employed by the other two laboratories. Another factor affecting recoveries of elements was the laboratory which analyzed the samples. It was suggested that mixtures of free and organically bound forms of elements be used as spikes to render a more realistic evaluation or recovery of 'total' metals to be made. (Geiger-FRC)
W81-00450

ANALYTICAL PROBLEM SOLVING WITH VERIFICATION SAMPLES INTERFERENCE REDUCTION OPTIONS,
PJB Laboratories/Jacobs Engineering, Pasadena, CA.
C. Jackson, R. Pavlick, H. Scholtz, and D. R. Rushneck.
Journal of Environmental Science and Health (A), Vol 15, No 5, Special Issue, p 513-523, 1980. 5 Fig, 8 Ref.

Descriptors: *Gas chromatography, *Pollutant identification, *Waste water(Pollution), *Separation techniques, Analytical techniques, Water-analysis, Hydrogen ion concentration, Mass spectrometry, Water pollution sources, Water chemistry, Chemical analysis, Sodium sulfate.

Gas chromatographic analysis of pollutants in waste waters may be complicated by the difficulty of separating the pollutant from the complicated matrices that can occur in process waste streams. After direct aqueous injection and microextraction have been performed to detect the compound of interest and it has been determined that interference exists, the simplest method to reduce this is to examine the relationship of the pH of the sample and interference. It the latter is pH sensitive and the compound is not, exchanging the pH of the water usually eliminates interference. If the reverse is true, column chromatography usually retards the compound, while the interference is eluted and discarded. A microcleanup technique, in which microextracts are subjected to Florisil column chromatography, may be used. This method requires 1-1/2 cm Pr-grade Florisil (180 mg) with 2 cm sodium sulfate in a disposable Pasteur pipette. An aliquot of the microextract (0.5 milliliter) is placed on the column and eluted with 2 milliliters of hexane. The column is then eluted with 2 milliliters of 20% ether in hexane, and the eluate analyzed for polar compounds. Other techniques are useful for reducing interferences in the case of particular compounds. Certain interferences may require cleanup by molecular weight distribution, separation by capillary columns, or the use of precolumns and back-flushing techniques. The analytical method is verified by spiking, a recovery of 50-150% of the spike validating the method. It is possible, using such techniques, to solve nearly every interference problem without resorting to mass spectrometry. (Gish-FRC)
W81-00452

AN EVALUATION OF FACTORS AFFECTING THE MICROEXTRACTION OF BENZENE, TOLUENE, ETHYLBENZENE AND O-XYLENE INTO PENTANE,
Little (Arthur D.), Inc., Cambridge, MA.
For primary bibliographic entry see Field 7B.
W81-00453

CHARACTERISTICS OF GEL CHROMATOGRAPHY USING SEPHADEX GEL FOR FRACTIONATION OF SOLUBLE ORGANIC POLLUTANTS,
Yokohama National Univ. (Japan). Dept. of Safety and Environmental Engineering.
For primary bibliographic entry see Field 7B.
W81-00493

MUTAGENICITY IN SALMONELLA OF FLUORESCENT DYE TABLETS USED IN WATER TRACING,
Health and Welfare Canada, Ottawa (Ontario). Environmental and Occupational Toxicology Div.
E. R. Nestmann, D. J. Kowbel, and J. Ellenton.
Water Research, Vol 14, No 7, p 901-902, July, 1980. 1 Fig, 13 Ref.

Descriptors: *Fluorescent dye, *Toxicity, *Tracking techniques, Bioindicators, Water pollution, Salmonella, Public health, Tracers, Mutagens, Bacteria.

Red and yellow/green fluorescent dye tablets currently used for water tracing were evaluated for their mutagenicity to five strains of Salmonella typhimurium. Rhodamine B and Uranine containing dyes were tested using the Ames procedure for bacterial His(+) revertants in the presence or absence of S9 mix. Red tablets containing Rhodamine B increased the number of His(+) revertant colonies in strains TA1538 and TA98 in the presence of S9 in a dose-dependent manner. Fluorescent yellow/green tablets containing Uranine (Fluorescein Sodium) showed no mutagenic activity in any of the strains tested. Since these dyes are available for commercial, public, and field use in sewage, plumbing, and water pollution tracing, it was recommended that in vivo mutagenicity/carcinogenicity studies be performed to assess possible hazards of these products to humans. (Geiger-FRC)
W81-00497

5B. Sources Of Pollution

THE INFLUENCE OF P-RETENTION BY SOILS AND SEDIMENTS ON THE WATER QUALITY OF THE LIONS RIVER,
H. D. Furness, and C. M. Breen.
Journal of the Limnological Society of Southern Africa (Bloemfontein), Vol 4, No 2, p 113-118, 1978. 1 Fig, 6 Tab, 30 Ref.

Descriptors: *Phosphorus compounds, *Soils, *Sediments, *Retention, *Water quality, Nutrient removal, Leaching, Rivers, Fluvial sediments, Phosphates, Fertilizers, Runoff, Watersheds(Basins), Eutrophication, Movement, Suspended solids, Evaluation, Particle size, Soil texture, Sands, Aluminum, Mathematical studies, Correlation analysis, Algae, Nitrogen compounds, South Africa, *Lions River(South Africa), *Midmar dam catchment(South Africa).

The impact of phosphorus-retention by soils and sediments on the concentration of phosphorus in the water of the Lions River, Midmar dam catchment area, South Africa, is reported. The amount of phosphorus added to the catchment area was estimated by fertilizer sales and the river sediment and water samples from six sites were analyzed for pH, P04-P, total-P, Al, and cation concentrations. The amount of P-retention by the specific soils was reduced when more fertilizer had been applied, even though all soils have high P-retention properties. This may be due to saturation of the Al sites of the soil particles which bind phosphorus. The P-retention ability was also found to be dependent on the sediment texture, with sand having the least ability and clay having the best. There is a significant negative correlation between pH and Al (3+) concentration. The concentrations of P04-P in the water possibly reflects an equilibrium between the sediment and the water and if the pH of the sediment decreased, more P would be liberated into the water. The P retention properties of the soils will keep P concentrations from the Lions River low and not much P04-P will reach the Midmar dam. Nitrogen is probably the limiting factor for algae growth in the dam, not phosphorus. (Sidney-IPA)
W81-00338

WATER QUALITY DEGREDATION DUE TO NON-POINT POLLUTION FROM URBAN SOURCES,
Delaware Univ., Newark. Dept. of Civil Engineering.
J. B. Carberry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124364, Price codes: A05 in paper copy, A01 in microfiche. Final report, January 1980. 62 p, 17 Fig, 14 Tab, 105 Ref. OWRT-B-018-DEL(3), 14-34-0001-8070.

Descriptors: *Lead, *Cadmium, *Water pollution sources, *Delaware, Automobiles, Storm runoff, Rain gages, Atomic adsorption, Bottom sediments, Solubility, Hydraulic models, Stochastic processes, Water sampling, Adsorption.

A study of the concentrations of cadmium and lead in the Christiana River in the Newark, Delaware, area showed that lead pollution originates from airborne automotive exhausts, while cadmium pollution originates from surface stormwater runoff. Four complete storm events were sampled for streamwater degredation analysis at five different sampling stations. Six storms were sampled for rainwater only. Rain-guages consisted of 1000 ml graduated cylinders topped with 8-inch diameter funnels. A portable Beckman pH meter was used for pH determinations and lead and cadmium concentrations were determined by atomic adsorption. All streamwater samples were grab samples. Rainwater pH showed a temporal variation for a storm event with increasing pH controlling the lead concentration, while cadmium did not exceed any possible solubility of pH-controlled precipitation. Lead was found to be associated with stream sediments while cadmium remained soluble. Stream sediments and soils suspended during a storm event have significant adsorption capacity. Hydraulic dispersion and stochastic models are used to describe stream responses to storm events. (Seigler-IPA)
W81-00339

NUTRIENT YIELD OF THE APALACHICOLA RIVER FLOOD PLAIN, FLORIDA: RIVER-QUALITY ASSESSMENT PLAN,
Geological Survey, Tallahassee, FL. Water Resources Div.
H. C. Mattraw, Jr., and J. F. Elder.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-103590, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-51, 1980. 21 p, 3 Fig, 1 Tab, 29 Ref.

Descriptors: *Nutrients, *Rivers, *Flood plains, *Wetlands, Detritus, River flow, Sampling, Measurement, Vegetation, Trees, Distribution patterns, Decomposing organic matter, Surface-groundwater relationships, Trace elements, Pesticides, *Florida, Remote sensing, *Apalachicola River(FL), *River quality.

The Apalachicola River in northwestern Florida is the location of one of four current U.S. Geological Survey National River Quality Assessments. The investigation of the Apalachicola River and flood plain is designed to quantify the organic detritus and nutrient yield to the productive, estuarine Apalachicola Bay. The extensive riverine flood plain is subject to seasonal flooding which transports large quantities of accumulated, decaying leaf litter from the flood plain into the river and ultimately into Apalachicola Bay. The Apalachicola River Quality Assessment has four major objectives; (1) Determine the accumulation of organic substances and trace elements in benthic organisms and fine-grained sediments; (2) Define the distribution of the major tree communities on the flood plain; (3) Assess the role of leaf fall and decomposition on nutrient yield; and (4) Identify and quantify major sources and pathways of nutrients to the river. Extensive emphasis is given to investigation approaches and techniques to facilitate technology transfer to similar wetland ecosystems. (USGS)
W81-00350

EVALUATION OF A CAVITY-RIDDLED ZONE OF THE SHALLOW AQUIFER NEAR RIVIERA BEACH, PALM BEACH COUNTY, FLORIDA,

Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-00351

A ONE-DIMENSIONAL, STEADY-STATE, DISSOLVED-OXYGEN MODEL AND WASTE-LOAD ASSIMILATION STUDY FOR THE WABASH RIVER, HUNTINGTON COUNTY, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Di.
C. G. Crawford, W. G. Wilber, and J. G. Peters.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225, paper copy, $7.75, microfiche $3.50. Geological Survey Open-File Report 80-75, January 1980. 55 p, 16 Fig, 3 Plates, 15 Tab, 52 Ref.

Descriptors: *Model studies, *Dissolved oxygen, *Waste assimilative capacity, *Water quality, *Indiana, Streams, Streamflow, Low flows, Reaeration, Water pollution, Waste water disposal, Waste water treatment, Biochemical oxygen demand, Nitrification, Ammonia, Nitrates, Nutrients, Mathematical models, *Huntington County(IN), *Wabash River(IN).

A digital model calibrated to conditions in the Wabash River in Huntington County, Ind., was used to predict alternatives for future waste loadings that would be compatible with Indiana stream water-quality standards defined for two critical hydrologic conditons, summer and winter low flows. The major point-source waste load affecting the Wabash River in Huntington County is the Huntington wastewater-treatment facility. The most significnt factor potentially affecting the dissolved-oxygen concentration during summer low flows is nitrification. However, nitrification should not be a limiting factor on the allowable nitrogenous and carbonaceous waste loads for the Huntington wastewater-treatment facility during summer low flows if the ammonia-nitrogen toxicity standard for Indiana streams is met. The disolved-oxygen standard for Indiana stream, an average of 5.0 milligrams per liter, should be met during summer and winter low flows if the National Pollution Discharge Elimination System's 5-day, carbonaceous biochemical-oxygen demands of a monthly average concentration of 30 milligrams per liter and a maximum weekly average of 45 milligrams per liter are not exceeded. (USGS)
W81-00354

ANALYSES OF WATER, BANK MATERIAL, BOTTOM MATERIAL, AND ELUTRIATE SAMPLES COLLECTED NEAR BELZONI, MISSISSIPPI (UPPER YAZOO PROJECTS),
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 1B.
W81-00355

A PRACTICAL LAGRANGIAN TRANSPORT MODEL,
Geological Survey, NSTL Station, MS. Water Resources Div.
H. E. Jobson.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO. 80225, Paper copy $4.50, microfiche $3.50. Geological Survey open-file report 80-206, 1980. 31 p, 7 Fig, 8 Ref.

Descriptors: *Computer models, *Model studies, *Streamflow, *Riverflow, *Dye releases, Tracers, Tracking techniques, Dispersion, Unsteady flow, Water temperature, Mathematical models, Georgia, *Chattahoochee River(GA), *Transport modeling.

An unconditionally stable and practical transport model for use in upland streams and rivers has been developed and verified. Basing the model on the Lagrangian, rather than the Eulerian, reference frame greatly reduces the numerical problems associated with solving the advective terms of the convective-diffusion equation. The model contains almost no numerical dispersion, is conceptually simple, and is relatively easy to code. Model results closely simulated dye concentrations measured in the Chattahoochee River near Atlanta, Ga. under highly unsteady flow conditions. (USGS)
W81-00360

CONTENT AND DISTRIBUTION PATTERNOF 2, 4-D IN THE RED RIVER,
Saskatchewan Dept. of the Environment, Regina. Inland Waters Directorate.
V. T. Chacko, and W. D. Gummer.
Technical Bulletin No. 115, 1980. 12p, 3 Fig, 13 Ref, 9 Tab.

Descriptors: *Water pollution, *Herbicides, *2, 4-dichlorophenoxyacetic acid, *Contaminants, *Agriculture, *Surveys, *Snalyses, Surface water, Aquatic environment, Red River, Manitoba, Canada, Path of pollutants.

Distribution of the herbicide 2, 4-D in the Red River between Emerson and Netley Lake was studied. The herbicide was found primarily in the water, less on the suspended sediment and not detectable in the bottom sediments and benthos. The recorded high concentration of 2, 4-D in February 1977 that prompted this study is believed to be derived in part from the effluent of the City of Winnipeg's North End Pollution Control Center, which was found to contain 30 500 ng/L 2, 4-D. There is no measurable accumulation of 2, 4-D in the deposited river sediment. This report also addresses (1) the variability of 3, 4-D concentrations attributed to the sampling technique, (2) the river cross-sectional heterogeneity and (3) the sample preservation technique. (WATDOC)
W81-00382

DEVELOPMENT OF AN OIL SPILL MODEL FOR THE ST. LAWRENCE RIVER,
Inland Waters Directorate, Ottawa (Ontario).
M. Fingas, and M. Sydor.
Technical Bulletin No 116, 1980. 25 p, 9 Fig, 32 Ref.

Descriptors: *St. Lawrence River, *Computer models, *Oil spills, *Water pollution, Path of pollutants, Hydrocarbons, Transport, Spill behaviour, Blo-ker's model, Fay's model, Simulation analysis.

The use of modelling to simulate the behaviour of spilled hydrocarbons under varying natural conditions is improving man's understanding of his environment. This report reviews some of the history of oil spill modelling and discusses many of the factors that must be considered in plotting the behaviour of bunker crude oil on the water surface. The report details procedures taken in developing an oil spill simulation model for the St. Lawrence River. (WATDOC)
W81-00386

OCCURRENCE OF HERBICIDE OXADIAZON IN SURFACE WATERS AND TAP WATER,
Kitakyushu Municipal Inst., of Environmental Health Sciences (Japan).
Y. Yamato, and M. Suzuki.
Water Research, Vol 14, No 10, p 1435-1438, October, 1980. 4 Fig, 3 Tab, 13 Ref.

Descriptors: *Surface waters, *Potable water, *Pesticide kinetics, *Oxadiazon, Herbicides, Gas chromatography, Mass spectrometry, Agricultural runoff, Rivers, Reservoirs, Japan, Water sampling, Seasonal, Pesticide residus.

The occurrence of oxadiazon in surface and tap water was investigated by gas chromatographic analyses of water samples taken from one Japanese tap water source, four Japanese rivers, and one Japanese reservoir. Positive identification of oxadiazon was confirmed by mass spectrometry. All samples taken monthly from April to February from the Tonda Reservoir site contained oxadiazon (range, 0.007 ppb in April to 0.304 ppb in August). In tap water, maximum levels of oxadiazon were found in July (0.093 ppb). High concentrations of oxadiazon residues were found after the beginning of rice seedling transplantation at the Higashitani, Nishitani, and Murasaki River sites, (June: 1.1953, 1.156, and 1.075, respectively) after which they rapidly decreased. At the Onga River site, oxadiazon levels ranged from 0.009 ppb in May to 0.445 in July. Oxadiazon residues ranged from 0.001 to 1.953 ppb from all sources tested, with levels in tap water being approximately 3-23% of those in raw water. (Geiger-FRC)
W81-00402

ARSENIC CYCLING IN MARINE SYSTEMS,
Woods Hole Oceanographic Institution, MA.
J. G. Sanders.
Marine Environmental Research, Vol 3, No 4, p 257-266, September, 1980. 2 Fig, 2 Tab, 40 Ref.

Descriptors: *Arsenic compounds, *Continental shelf, *Sediments, *Path of pollutants, Aquatic environment, Rivers, Saline water intrusion, Georgia, Gulfs, Sea water, Atmosphere, Water pollution, Southeast U.S.

The arsenic cycle and recent advances in its study are reviewed with special attention given to the major reactions of arsenic in the continental shelf area of the Georgia Bight. Arsenic is uniformly distributed throughout the marine environment with some concentration in coastal areas due to anthropogenic additions. It occurs naturally in oceans in several oxidation states and often enters into reactions with marine biota. The cycle of arsenic in marine sediments is not well known. The rivers of the southeastern portion of the United States supply little arsenic to the Georgia Bight through runoff waters (10,000 kg/yr according to one investigator). Atmospheric arsenic is a very minor contributor to the arsenic levels of the Georgia Bight (13,000 kg/yr). Diffusion from sediments amounts to 4,800 kg/yr. Arsenic in rainfall in the vicinity of emissions may contain elevated levels of arsenic. The residence time for arsenic in Bight waters is approximately 3 months. Arsenic entering the Bight is largely dissolved as opposed to particulate. The major input of arsenic into the Bight is by way of intrusion subsurface Gulf Stream waters (4 million kg/yr). Changes in arsenic speciation occur by indiscriminate biological uptake involving about 20% of the dissolved arsenate pool and producing measurable levels of methylated and reduced species. Although the overall cycle of arsenic resembles the phosphate cycle, the regeneration period for arsenic is much longer. (Geiger-FRC)
W81-00403

BEHAVIOUR OF HCH (1,2,3,4,5,6-HEXACHLOROCYCLOHEXANE) RESIDUE IN THE AQUATIC ENVIRONMENT,
Kitakyushu Municipal Inst. of Environmental Health Sciences (Japan).
Y. Yamato, M. Suzuki, K. Shimohara, and T. Akiyama.
Water Research, Vol 14, No 3, p 247-251, March, 1980. 4 Fig, 2 Tab, 16 Ref.

Descriptors: *Chlorinated hydrocarbon pesticides, *Surface waters, *Pesticide kinetics, Gas chromatography, Rivers, Reservoirs, Agricultural runoff, Persistence, Runoff forecasting, Sampling, Seasonal, Water pollution sources.

Knowledge of the behavior of organochlorine pesticides in surface waters is helpful in evaluating the contamination of field soils with these components. To this end, surface water samples taken monthly for 1 yr from five sites in Japan representing three rivers and one reservoir were analyzed for levels of 1,2,3,4,5,6-hexachlorocyclohexane (HCH) by gas liquid chromatography. Equations of the waves derived from plotting log concentrations of HCH against time were calculated from monthly variations at each sampling site. At all five sites, HCH was found in higher levels during the summer and at lower concentrations in the winter. At the river sites, maximum HCH concentration was found in August. This was thought to be due to HCH residing in paddy field soils that flowed out with repeated flooding. Of all the sampling sites, the amplitude of the wave described by the data from the reservoir was the smallest. The slope of the wave at a downstream sampling site was smaller than that at a site upstream on the same river. Projected maximum total HCH concentra-

tions for 1985 show that levels at the upper stream will be about a hundredth or a thousandth of those downstream. Estimates for the five sites for 1985 ranged from .0000015 to .003 ppb HCH. Equations also showed that beta-HCH was more persistent than gamma-HCH in surface water. Estimates for 1985 indicated that the ratio of beta-HCH to total HCH in surface water would be approximately 60%. (Geiger-FRC)
W81-00410

MOVEMENT OF 2,4,5-T THROUGH LARGE SOIL COLUMNS,
New Mexico State Univ., Las Cruces. Dept. of Agronomy.
G. A. O'Connor, P. J. Wierenga, H. H. Cheng, and K. G. Doxtader.
Soil Science, Vol 130, No 3, p 157-162, September, 1980. 7 Fig, 16 Ref.

Descriptors: *2,4,5-T, *Soil water movement, *Tritium, *Computer models, Chlorinated hydrocarbon pesticides, Herbicides, Pesticides, Clay loam, Soils, Pesticide kinetics, Adsorption, Biodegradation, Flow, Sorption, Greenhouses, Path of pollutants, Irrigation.

The movement of tritiated waters and 2,4,5-T, an herbicide, through large soil columns was investigated. Adsorption in Glendale clay loam conformed to the Freundlich relationship up to an equilibrium herbicide concentration of about 20 micrograms/ml. Desorption studies indicated more hysteresis than previously reported. Degradation studies confirmed the relatively slow biological degradation of 2,4,5-T previously reported. One study indicated that 2,4,5-T applied at 80 micrograms/ml remained in Glendale soil for about 85 days in large soil columns under similar greenhouse conditions. Predicted and observed tritium concentrations in both the effluent and inside the column were used to evaluate the ability of a computer model to simulate transient state water flow in soil. The model incorporated both the adsorption-desorption and biological degradation processes. The model successfully predicted tritiated water distributions after several irrigations. Predicted and observed distribution of the herbicide over the first few days were closely similar, indicating the effectiveness of the model. Movement of the sorbable herbicide was retarded in relation to the movement of the water in which it was dissolved. However, movement of the herbicide through the soil after the second and third irrigations was not adequately described by this model. No 2,4,5-T was found in the drainage from the soil columns. (Baker-FRC)
W81-00411

LEACHING LOSSES OF TWO NUTRIENTS AND AN HERBICIDE FROM TWO SANDY SOILS DURING TRANSIENT DRAINAGE,
Florida Univ., Gainesville. Dept. of Soil Science.
R. S. Mansell, W. B. Wheeler, and D. W. Calvert.
Soil Science, Vol 130, No 3, p 140-150, September, 1980. 8 Fig, 5 Tab, 13 Ref.

Descriptors: *Potassium, *Nitrogen compounds, *Herbicides, *Leaching, *Sprinkler irrigation, Pesticides, Irrigation, Flow, Subsurface waters, Drainage, Soil water, Cultivation, Rainfall, Nutrients, Nitrates, Nitrification, Water table, Soil types, Acid soils.

Shallow-tilled (ST) and deep-tilled (DT) plots of an acid, sandy soil were used to measure changes in potassium, nitrogen nitrates, and Terbacil concentrations in subsurface drainage water from the plots. Fertilizer (equivalent to 35.18 kg/ha K, 19.07 kg/ha NO3-N, and 23.31 kg/ha NH4-N) and Terbacil herbicide (4.5 kg/ha) was applied to the soil. Transient water flow was applied to the plots for a 2-wk period after 7.6 cm of irrigation had been achieved. Rainfall occurred 10, 11, and 12 days after fertilizer and Terbacil application (total water, 4.8 cm). ST drainage water contained higher concentrations of all solutes than did DT drainage water. In ST soils, the water table rose to within 100 cm of the surface during sprinkler applications of water, whereas in DT the water table rose to within 60 cm. In the DT soil, the discharges of potassium, nitrogen producing nitrates, and Terbacil were only 29.6, 37.0, and 13.9%, respectively as large as those in the ST soil. This was due to the slower drainage, higher soil-water contents, and higher clay content and organic matter present in the upper 60 cm of the DT soil. Total cumulative drainage from DT soil was only 51.1% that from ST soil. Thus, relatively small quantities of irrigation and rainfall produced relatively large nutrient discharges. As irrigation was begun soon after fertilizer application, the leaching loss of these solutes would be expected to be greater than if water application had occurred later. (Baker-FRC)
W81-00414

BEHAVIOUR OF 12 INSECTICIDES IN SOIL AND AQUEOUS SUSPENSIONS OF SOIL AND SEDIMENT,
Malaysian Agricultural Research and Development Inst., Selangor.
M. S. Sharom, J. R. W. Miles, C. R. Harris, and F. L. McEwen.
Water Research, Vol 14, No 8, p 1095-1100, August, 1980. 6 Fig, 4 Tab, 15 Ref.

Descriptors: *Sediments, *Soils, *Pesticide kinetics, *Insecticides, *Path of pollutants, Chlorinated hydrocarbon pesticides, Organophosphorus pesticides, Leaching, Carbamate pesticides, Adsorption, Stream erosion, Soil types, Organic soils, Loam, Sands, Absorption, Solubility, DDT, Dieldrin, Diazinon.

Pesticides and their degradation products may enter the aquatic environment by leaching directly to streams or ground waters or by erosion of contaminated soils into streams. Once in an aquatic environment, the more adsorptive compounds will adhere to the sediments. The behavior of 12 insecticides representing the organochlorine, organophosphorus, and carbamate groups was tested in soil and in aqueous suspensions of soil and a stream sediment under laboratory conditions. Adsorption onto soil followed the order DDT > leptophos > dieldrin > endrin > ethion > chlorpyrifos > lindane > parathion > diazinon > carbaryl > carbofuran > mevinphos. The absorption of insecticides to soil or sediment was in general inversely correlated with the solubility of the insecticide in water. The absorptive capacity of the soils and sediments for the insecticides followed the order organic soil > stream sediment > Beverly sandy loam > Plainfield sand. Mobility and desorption of insecticides was found to increase with the solubility of the insecticide in water. These findings indicate that the water solubility properties of the insecticide and the nature of the adsorbents play a greater role than compound structure in determining the adsorption, desorption, and mobility behavior of an insecticide in soil and water. (Geiger-FRC)
W81-00499

5C. Effects Of Pollution

ENVIRONMENTAL IMPACT OF A NUCLEAR PLANT ON MISSISSIPPI RIVER BIOTA IN AN ECOLOGICAL RECOVERY ZONE NEAR RED WING, MINNESOTA,
Saint Mary's Coll., Winona, MN. Dept. of Biology.
L. J. Dieterman, and D. R. Mc Conville.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-120610, Price codes: A13 in paper copy, A01 in microfiche. Final Report submitted to Office of Water Research and Technology (1980), 269 p, 55 Fig, 66 Tab. OWRT-C-4343(No 9051)(1), 14-31-0001-9051.

Descriptors: *Thermal pollution, *Biota, Water pollution, Telemetry, Fluorometry, *Fish behavior, *Mississippi River, Fish movement, Population dynamics, Phyto-, Benthos, Macrophyte, *Nuclear powerplants, *Minnesota, Red Wing(MN).

The biota of the Mississippi River in an ecological recovery zone near Red Wing, MN was studied before and after start-up of a nuclear plant to acquire baseline data and to estimate changes due to thermal addition. Thermal addition produced significant decreases in primary production in a plant region during summer month periods when water temperatures were near 36 degree C. Other regions were not affected due to eutrophic waters and efficient mixing of large water volumes. Extensive fisheries studies and sonar tagging/tracking of S. vitreum were performed. Comparison of fisheries results with other riverine, lake, and pond studies indicated a favorable environment for the success of the fish species studied. Qualitative macroinvertebrate surveys were conducted. The area supports a large and diverse macroinvertebrate community characteristic of a healthy freshwater stream. River modifications in the recycle canals produced a unique aquatic ecosystem. Macroinvertebrate population differences in this region were noted.
W81-00262

IMPACT OF IRON DISCHARGES FROM WASTEWATER TREATMENT PLANTS ON ALGAL GROWTH AND SPECIES COMPOSITION,
State Univ. of New York Coll. at Fredonia. Environmental Resources Center.
T. A. Storch, and V. L. Dunham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-120602, Price codes: A06 in paper copy, A01 in microfiche. Center for Environmental Research, Cornell University, Ithaca, New York. Completion Report, October 1980. 104 p, 40 Fig, 19 Tab, 36 Ref. OWRT-B-074-NY(2), 14-34-0001-8102.

Descriptors: *Algae, *Chlorophyts, Algal bioassays, Algal metabolism, Blue-green algae, Green algae, *Iron, Nitrogen metabolism, Nitrification, Photosynthesis, Community composition, *Waste water(Pollution), Effects, Plant growth, *Phytoplankton, *Lake Erie, *Chautauqua Lake(NY), Anabaena flos-aquae, Scenedesmus bijugatus, Selenastrum capricornutum, Nitrate reductase, Nitrite reductase, Glutamine synthetase.

Unialgal cultures and lake assemblages of phytoplankton were studied to determine the effect of iron enrichment on algal metabolic processes and community composition. Phytoplankton assemblages from Lake Erie and Chautauqua Lake, N.Y. were generally inhibited following enrichment with unchelated iron. The degree of inhibition in lake water was small and it occurred as a result of extracellular interactions between iron and soluble ions (phosphorus and possibly some trace metals). Increases in photosynthesis following the addition of EDTA-chelated iron to lake water was shown to result primarily from the effect of EDTA alone on algal metabolism. Lake diatom populations appeared to be the most sensitive to iron. However, iron enrichment did not enhance lake populations of blue-green algae nor did it cause major shifts in the composition of the phytoplankton community. Investigations with defined nutrient media indicated that iron enrichment stimulated the growth of unialgal cultures primarily only in nutrient-rich media. Under iron limiting conditions, iron enhanced cellular growth, photosynthesis and chlorophyll a content in both green and blue-green algae. Iron also stimulated the enzymes (nitrate and nitrite reductase and glutamine synthetase) involved in nitrogen metabolism in blue-green algae, but inhibited their activity in green algae. Iron was also observed to be important in the early stages of heterocyst formation by blue-green algae.
W81-00265

LAKE SAMMAMISH RESPONSE TO WASTEWATER FIVERSION AND INCREASING URBAN RUNOFF,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2H.
W81-00274

EFFECTS OF WATER-BORNE MIREX ON THE SURVIVAL AND PRODUCTION OF MACROBRACHIUM ROSENBERGII (DE MAN),
Clemson Univ., SC.
A. G. Eversole.

Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124091, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute, Clemson University. Technical Report No 88, June 1980. 44 p, 6 Fig, 16 Tab, 29 Ref. OWRT-B-115-SC(1).

Descriptors: *Water pollution effects, *Aquiculture, *Pesticides, *Crustaceans, Bioassay, Gas chromatography, Pesticide toxicity, *Mirex, Prawns, Macrobrachium rosenbergii, Chlorinated hydrocarbons, Shrimp.

Water-borne mirex, in concentrations above 100 microg/l, was lethal to postlarval Macrobrachium rosenbergii in a 24-hour exposure acute toxicity experiment. Adult and juvenile prawns did not show a clear relationship between survival and concentration when exposed to mirex in water for 24 hours. Postlarvae exposed to mirex in water for 96 hours, with 10 prawns per test container, exhibited reduced survival with increasing mirex concentration. Individually exposed postlarvae (96 hours) did not exhibit such a distinct mortality pattern. A significant increase in length of molt intervals with increasing concentration was found for postlarvae individually exposed to mirex in water for 96 hours. Potential production figures, calculated from data for prawns individually exposed indicate an increase in production (wet weight) of controls 2.24 and 1.70 times that of prawns exposed to 100 and 10 microg/l, respectively. Mirex residues in the tested postlarvae generally increased with increasing mirex concentration. Residues of mirex in postlarvae exposed to mirex for 24 hours (no food was present during the exposure period) suggest that M. rosenbergii can absorb mirex from the surrounding water. Water samples showed a marked decrease in mirex residues after 96 hours.
W81-00326

SECONDARY FIBRES PULPING/DEINKING EFFLUENT TOXICITY STUDY,
Beak Consultants Ltd., Vancouver (British Columbia).
Environmental Protection Service, Ottawa, Ontario, Canada, Water Pollution Control Directorate. Economic and Technical Review Report EPS 3-WP 79-6, 1979. 37 p, 16 Tab, 22 Ref.

Descriptors: *Pulp wastes, *Effluents, *Analyses, *Bioassay, *Toxicity, Heavy detergents, Pulp washing(Deink), Characteristics, Treatment, Sampling, Canada.

The effluents from five integrated secondary fibre pulping (SPP)/deinking mills located in the north mid-western United States and Eastern Canada were sampled for toxicity during the period November 1977 to February 1978. The untreated effluent from the SFP/deinking mills was found to be toxic and it was determined that the toxicity was contributed by the pulp washing (deinking) effluent stream. Contributors to toxicity found in the deinking effluent included: fibre, alkaline pH, polychlorinated biphenyls (PCBs), heavy metals and detergents. No correlation was established between changes in the individual toxicant concentrations and the variations in effluent toxicity. The pulp washing stream contained both a foam and a liquid fraction. The foam fraction exhibited much higher toxicity and contained higher concentrations of toxicants than the liquid portion. Settling of the pulp washing effluent prior to bioassay testing reduced toxicity, while setting of the untreated toal mill effluent did not significantly reduce toxicity. The deinking process is fully described, as are the defibering processes at each mill. A brief review of the literature is also presented. (WATDOC)
W81-00388

THE POTENTIAL FOR NITROGEN FIXATION IN A LAKE RECEIVING SEWAGE EFFLUENT (GRASMERE, ENGLISH LAKE DISTRICT),
Freshwater Biological Association, Ambleside (England).
K. L. Jones, J. V. Roscoe, and J. G. Jones.
Journal of Applied Bacteriology, Vol 49, No 1, p 143-154, August, 1980. 6 Fig, 3 Tab, 37 Ref.

Descriptors: *Water sampling, *Lakes, *Sewage effluents, *Nitrogen fixing bacteria, Sediments, Seasonal, Nitrogen, Dissolved oxygen, Epilimnion, Hypolimnion, Cores, Nitrogen fixation, Thermal stratification, Ammonium compounds, Reduction(Chemical), Water pollution, Analytical techniques.

The potential for nitrogen fixation in the sediment and water column was studied at three sites in Grasmere, a lake in the English Lake District. The light-independent acetylene-reduction technique was employed for samples taken at different seasons, and at sites with varying levels of inorganic nitrogen and dissolved oxygen in the epilimnion and hypolimnion. Most probable number (MPN) counts of nitrogen fixing bacteria were carried out on glucose-supplemented medium for non-photosynthetic organisms and on ASM medium for cyanobacteria. Differences within a sediment core and between cores, and the method and medium for MPN determinations of potential nitrogen fixers were studied in preliminary investigations. Good correlations were found between potential rates of nitrogen fixation and MPN counts of nitrogen-fixing bacteria and between these parameters and decreases in levels of dissolved oxygen. During the period of thermal stratification, selective changes in the nitrogen-fixing microflora seemed to occur. Light-dependent fixation and cyanobacteria were undetectable in the water column. Acetylene reduction was found for most of the season in samples of water and sediment to which a carbon and phosphorus source have been added. It was concluded that sewage effluent has changed the nitrogen cycle and suppressed nitrogen fixation in Grasmere by increasing the level of ammonium throughout the lake, and by general enrichment. (Geiger-FRC)
W81-00404

VARIABILITY IN MICROBIOLOGICAL DATA FROM A STRATIFIED EUTROPHIC LAKE,
Freshwater Biological Association, Ambleside (England).
For primary bibliographic entry see Field 2H.
W81-00405

CANCER INCIDENCE AND TRIHALOMETHANE CONCENTRATIONS IN A PUBLIC DRINKING WATER SYSTEM,
Arkansas Univ. Medical Sciences Campus, Little Rock. Div. of Biometry.
G. L. Carlo, and C. J. Mettlin.
American Journal of Public Health, Vol 70, No 5, p 523-525, May, 1980. 2 Tab, 1 Ref.

Descriptors: *Potable water, *Chlorination, *Public health, Municipal water, Halomethanes, Cancer, New York, Water supply, Water sources, Groundwater, Surface waters, Water quality, Toxins, Epidemiology.

Consideration was given to 4,255 cases of esophageal, stomach, colon, rectal, bladder, and pancreatic cancers reported in Erie County to the New York State Tumor Registry between 1973 and 1976. A relationship was sought between cancer incidence and the concentration of trihalomethanes, by-products of chlorination, present in the various drinking water supplies. Control variables were socio-economic status, mobility, percent nonwhite, and urbanicity. Water source was divided into two types: surface (lake, river, reservoir) and ground (well, spring). A positive association was found between surface water as the source of supply and the incidence of esophageal and pancreatic cancer (Pearson correlation coefficient, r, $= -0.16$, $p < 0.05$). A positive correlation was also found between concentrations of trihalomethanes and the incidence of pancreatic cancer among white males ($p < 0.05$). However, for the total population studied, levels of trihalomethanes were not correlated with cancer incidence of any site. (Baker-FRC)
W81-00406

MUTAGENIC ACTIVITY IN DRINKING WATER,
Tulane Univ., New Orleans, LA. Dept. of Environmental Health Sciences.
N. Gruener, and M. P. Lockwood.
American Journal of Public Health, Vol 70, No 3, p 276-278, March, 1980. 1 Tab, 10 Ref.

Descriptors: *Potable water, *Mutagens, *Carbon, Total organic carbon, Laboratory tests, Laboratory animals, Public health, Municipal water, Cytological studies, Louisiana, Toxins, Water pollution sources, Water quality.

Samples of New Orleans tap water were concentrated through freeze drying, and the mutagenic and promoting activities of the water were tested by exposing Chinese hamster embryonic lung cells (V79) to the concentrated water for 2 hr. After exposure, cytotoxicity was determined by a reduction in plating efficiency compared with acetone-treated controls. Water samples containing only 140 mg/liter of total organic carbon (TOC) caused no mutagenic activity. However, a dose of 480 micrograms TOC from New Orleans drinking water caused a mutation frequency of 7.1 mutants/million surviving cells. It was calculated that the average daily intake of TOC through drinking water in New Orleans is 3,000 micrograms. Cells exposed to the potent promoter 12-O-tetradecanoyl-phorbol-13-acetate prior to exposure to the water demonstrated increased mutation frequencies. Tests on the water itself showed it to enhance benzo(a)pyrene mutagenicity approximately 100%. This may indicate that chemicals contaminating water can enhance carcinogenicity of other environmental factors such as air pollutants. The finding that water contains compounds which can directly or indirectly affect cellular DNA should be considered when bioassay carcinogenicity tests are designed. While these tests do consider the diet of the animals being studied, a little or no attention is given to the purity of their drinking water. (Baker-FRC)
W81-00408

LAKE WEEDS CAN BE CONTROLLED,
K. Grover.
American City and County, Vol 95, No 3, p 63-65, March, 1980. 4 Fig.

Descriptors: *Aquatic weed control, *Lakes, *Eutrophication, *Aging(Biological), Nutrients, Sewerage, Phosphates, Settling basins, Dams, Watershed management, Dredging, Weeds, Harvesting, Drawdown, Water levels, Nitrogen, Water pollution control, Herbicides, Farm ponds.

d control is to limit the nutrients entering a lake. While effective watershed management practices, including proper sewering, limited use of phosphates, and the development of siltation settling ponds and dams, will decrease the nutrient supply, these steps are not the major answer. At Vandalia, Missouri, dredging was used to remove 80,000 cu yards of silt and weeds in the city reservoir. Dredging at Long Lake, Michigan removed 840,000 cu ft of sediment, killed all weeds and improved recreational water uses. Problems involve cost and disposal of dredge spoil. Five cutters, eight weed transports and support machinery harvest 7,000-8,000 acres of water weeds each year in Dane County, Wisconsin. Lake level drawdown at Black Lake, Louisiana achieved 100% control of elodea and 78-100% control of fanwort. The use of herbicides is controversial. In Missouri, dichlobenil controlled weeds in farm ponds, but also caused a 70-100% increase in nitrogen and phosphorus concentrations due to decomposition of vegetation. Sediment covers placed on the bottom of lakes have been effective and provide immediate control. Biological control has been achieved through the use of snails, crayfish or the white amur. (Baker-FRC)
W81-00418

RESPIRATION OF AQUATIC INSECT LARVAE (EPHEMEROPTERA, PLECOPTERA) IN ACID MINE WATER,
Ohio Univ., Athens. Dept. of Zoology.
F. G. Doherty, and W. D. Hummon.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 358-363, September, 1980. 2 Tab, 19 Ref.

Descriptors: *Mayflies, *Stoneflies, *Acid mine water, *Respiration, Oxygen requirements, Toxicity, Mine wastes, Aquatic insects, Larvae, Water pollution effects.

Two species of Ameletus mayfly larvae (Ephemoroptera) and stonefly larvae (Plecoptera; Acroneuria xanthenes) were exposed to acid mine water for a period of 3 hr to measure the mine water's effect on oxygen consumption and respiratory rate. Median lethal time (LT50) values were determined by probit analysis, and oxygen consumption/hr was measured by calculations of regression coefficients by least squares. LT50 was 21.4 hr for A. lineatus and 29.0 hr for both Ameletus species. In each species the log transformation of oxygen consumption (microliters O2/g hr) was found to decrease with increasing individual dry weight. Oxygen consumption/unit weight, represented by a regression coefficient, differed from zero only for A. lineatus and A. xanthenes. Statistical comparisons betweeen regression coefficients obtained from sequential measurements of respiratory rates on solitary individuals showed that a majority of larvae exhibited similar rates regardless of the solution (control or acid mine water) to which they were exposed for second rate determinations. Intervention in the respiratory process by extraneous factors out of the scope of this experiment was suspected. Rates of osygen consumption for control and acid waters without test animals were negligible, showing the absence of bacterial contamination. It is concluded that the toxic mode of action of acid mine water did not operate through mechanisms that can be measured by respirometry. (Geiger-FRC)
W81-00420

AMMONIUM INPUT TO THE SEA VIA LARGE SEWAGE OUTFALLS-PART I: TRACING SEWAGE IN SOUTHERN CALIFORNIA WATERS,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
W. H. Thomas, and A. J. Carsola.
Marine Environmental Research, Vol 3, No 4, p 277-289, September, 1980. 6 Fig, 1 Tab, 19 Ref.

Descriptors: *Ammonium compounds, *Phytoplankton, *Outfall sewers, *Tracking techniques, Sea water, On-site tests, Waste dilution, Pollutant identification, Coliforms, Turbidity, Chlorination, Baseline studies, Dissolved oxygen, Sewage treatment, Effluents, Water pollution sources, California, Sewage effluents.

High ammonium concentrations were found in sea water near large sewage outfalls off Southern California. This nutrient has potential use as a tracer of sewage discharge. Samples from seven or more depths were taken seasonally and monthly near three sewage outfalls. Turbidity, prevailing currents, and routine water quality parameters were measured. In June-July, ammonium levels were significantly higher than control levels (Camp Pendleton) at the White Point Outfall (30.2 mg-atom/sq m, 539% of control). In September-October, levels were significantly higher than the control at Hyperion Outfall (27.9 mg-atom/sq m, 3,390%) and Point Loma Outfall (5.3 mg-atom/sq m, 757%). In January-February, the corresponding figures were 85.6 mg-atom/sq m (465%) at Hyperion and 64.1 mg-atom/sq m (348%) at Point Loma. High ammonium levels were found associated with turbid layers, prevailing currents, detectable coliform bacteria (in one case only), and undersaturated dissolved oxygen concentrations. In addition, high concentrations of ammonium are associated with slowed phytoplankton assimilation rates linked to the inhibition of phytoplankton growth in outfall receiving waters. Use of ammonium as a tracer could also indicate the degree of dilution of sewage. However, it is dependent on adequate analytical methods and on sewage which has not received secondary treatment. (Titus-FRC)
W81-00426

AMMONIUM INPUT TO THE SEA VIA LARGE SEWAGE OUTFALLS - PART 2: EFFECTS OF AMMONIUM ON GROWTH AND PHOTOSYNTHESIS OF SOUTHERN CALIFORNIA PHYTOPLANKTON CULTURES,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
W. H. Thomas, J. Hastings, and M. Fujita.
Marine Environmental Research, Vol 3, No 4, p 291-296, September, 1980. 2 Tab, 11 Ref.

Descriptors: *Ammonium, *Dinoflagellates, *Phytoplankton, *Sea water, *Eutrophication, *Chlorination, Heavy metals, Growth rates, Photosynthesis, Laboratory tests, Marine algae, Toxicity, Diatoms, Outfall sewers, Effluents, California, Water pollution sources, Sewage effluents.

Tests were conducted on the effects of ammonium concentrations on the growth of six marine phytoplankton from Southern California which might be exposed to high ammonium levels in water near sewage outfalls, particularly the Whites Point outfall. Ammonium in concentrations up to 200 microgram-atom/liter was added to cultures of three diatoms (Asterionella japonica, Skeletonema costatum, Chaetocerus affinis), two dinoflagellates (Gymnodinium splendens, Gonyaulax polyedra), and an organism of the Dunaliella species. At concentrations of 150 and 200 microgram-atom/liter, growth rates were inhibited in the two dinoflagellate cultures. Photosynthesis was inhibited in Gymnodidium splendens at 100 and 200 microgram-atom/liter. This dinoflagellate is noteworthy as part of the anchovy food chain. Other phytoplankton were virtually unaffected. Levels of ammonium near sewage outfalls were found to lie mostly between 10 and 30 microgram-atom/liter, which would not inhibit phytoplankton growth. It is hypothesized that other factors such as heavy metals or chlorine compounds associated with chlorinated sewage may inhibit phytoplankton growth, and that ammonium may even be a factor contributing to eutrophication near sewage outfalls. (Titus-FRC)
W81-00427

POSSIBLE EFFECTS OF PHOSPHORUS ON ALGAL GROWTH IN BARTON BROAD AND *RELATED CONTROL MEASURES,*
Anglian Water Authority (England). Norfolk and Suffolk River Div.
M. G. W. Bell, and F. H. Jones.
Water Pollution Control, Vol 79, No 2, p 177-194, 1980. 5 Fig, 10 Tab, 19 Ref.

Descriptors: *Phosphorus, *Nutrient removal, *Algal control, *Lakes, Eutrophication, River systems, Inland waterways, Sewage treatment, Water pollution control, Sewage effluents, Treatment facilities, Agricultural runoff, Bottom sediments.

Attempts to reduce the phosphorus levels in Barton Broad, Norfolk, England to a concentration which would support the coexistence of algae and higher plants are described. Barton Broad lies in the valley of the River Ant. Macrophyte growth in this broad has been attributed to eutrophication and dense phytoplankton blooms. Sewage effluents and drainage from agricultural lands provide nutrients to Barton Broad via the River Ant, however, these sources do not account for the 1,300 kg/yr of phosphorus which reaches the Broad. It was suggested that phosphorus entered from river beds, and studies to ascertain this were undertaken. Increased dissolved phosphorus levels were detected in bottom muds and were believed to be due to discharges from the sewage effluent sources at Stalham and North Walsham Sewage Treatment Works. Measurements of annual loadings of phosphorus at both sites indicated that reduction of phosphorus discharge at each site would be necessary to attain the target steady-state level of 100 micrograms P/liter in the Broad. The Stalham works were upgraded for increased phosphorus removal by using ferric sulfate, while innovations at the North Walsham plant were deferred in lieu of future plans for possible sea discharge. Over 90% phosphorus removal was achieved at Stalham, but the frequent monitoring required by the upgraded process will require further work. Discussions on phosphorus control work in the Broad follow this article. (Geiger-FRC)
W81-00430

THE WATER-FERN SALVINIA MOLESTA IN THE SEPIK RIVER, PAPUA NEW GUINEA,
Office of Environment and Conservation of Papua New Guinea, Port Moresby.
D. S. Mitchell, T. Petr, and A. B. Viner.
Environmental Conservation, Vol 7, No 2, p 115-122, Summer, 1980. 4 Fig, 4 Tab, 15 Ref.

Descriptors: *Ferns, *Aquatic weeds, *Lakes, *Lagoons, Nutrients, Phosphorus, Nitrogen, Rivers, Aquatic plants, Water resources development, Water pollution, Water pollution control, Fishkill, Governments, United Nations, Asia, Aquatic weed control.

The backwaters of the Sepik River between Pagwi and Angoram in Papua New Guinea have been heavily overgrown since 1977 with Salvinia molesta, an exotic water-fern that was introduced into the area in the early 1970s. Salvinia covered approximately 80 sq km by May of 1979 and the physico-chemical properties of lagoons and lakes of the Sepik River were investigated to determine the effects of nutrients on the ferns. Dissolved nitrogen and phosphorus did not show extreme concentrations when compared with other waters but did show an influence from Salvinia and other aquatic plants. Dissolved phosphate-phosphorus was only about 25% of that on the open Sepik near or under weed beds, while nitrate nitrogen values near or under weed beds were only about 10% of those of the open river. Examinations of the silt load of the Purari River to the south showed available phosphate phosphorus for plant metabolism. Overgrowth of Salvinia has caused declines in Saltfish Tilapia (Sarotherodon mossambicus) fisheries, crocodile hunting, and sago-palm collection. Blockage of waterways has hindered transportation and the development of tourism. Programs to manage the growth of Salvinia are being conducted by local, provincial, and central government and the United Nations; however, the complete elimination of the weed from the backwaters of the Sepik River does not seem likely. The overgrowth of the fern illustrates the danger of introducing exotic species into alien environments. (Geiger-FRC)
W81-00431

UPTAKE OF TRACE METALS BY THE CLAM MACOMA INQUINATA FROM CLEAN AND OIL-CONTAMINATED DETRITUS,
Battelle Pacific Northwest Lab., Sequim, WA. Marine Research Lab.
E. A. Crecelius, J. M. Augenfeld, D. L. Woodruff, and J. W. Anderson.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 337-344, September, 1980. 3 Fig, 3 Tab, 7 Ref.

Descriptors: *Clams, *Oil pollution, *Trace elements, *Sea water, Water pollution, Radioisotopes, Neutron activation analysis, Suspended solids, Aquatic animals, Metals, Chromium, Cobalt, Iron, Zinc, Detritus.

Clams (Macoma inquinata) were exposed to clean and oil-contaminated neutron-activated detritus (suspended matter in Sequim Bay water settled out in a laboratory flowing sea water system) for periods of 2, 4, 8 and 15 days to measure the uptake of tract metals by marine detritivors. After 15 days of exposure, depuration of the remaining clams was carried out in tanks filled with clean water and non-labeled detritus for 2 or 8 days. Uptake of Cr-51, Co-60, Eu-152, Fe-59, Sc-46, and Zn-65 was measured in clams and adjusted according to the rate of decay for each isotope to account for the time each sample was removed from the exposure tank. No difference was found in the quantity of Co released to sea water by oiled and non-oiled sediments. Co was the only metal which appeared consistently in sea water and clam shells at detectable levels. Cr, Eu, and Sc appeared in sea water sporadically, while Fe and Zn were not detected at all. Clams transferred to tanks with non-labeled detritus quickly lost radioactive material so that only 1-10% of the original radioactivity remained after 8 days. Cr was found in only three clam samples. Eu was not absorbed from the gut, and no evidence was found of Fe uptake. In general, less oiled than non-oiled detritus was ingested, making smaller amounts of labeled metal available for absorption across the walls of the intestinal tract.

There was no evidence that more Co was taken into the shells from oiled than from non-oiled detritus. (Geiger-FRC)
W81-00434

EFFECTS OF ROUNDUP HERBICIDE ON POPULATIONS OF DAPHNIA MAGNA IN A FOREST POND,
Northwest Ecological Animal Research Ltd., Vancouver (British Columbia).
L. D. Hildebrand, D. S. Sullivan, and T. P. Sullivan.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 353-357, September, 1980. 1 Fig, 1 Tab, 8 Ref.

Descriptors: *Daphnia, *Ponds, *Herbicides, Toxins, Toxicity, Aquatic animals, Aquatic life, Water pollution, Water pollution effects, Pesticides, Defoliants, Forests.

The toxicological effects of a range of concentrations of Roundup herbicide on populations of Daphnia magna were studied in a forest pond. Roundup is a commercial formulation containing 356 g/liter present as isopropylamine salt, and enters bodies of water through defoliation of vegetation in the treated area. The experimental pond measured 60 by 24 m and reached depths of 3-4 m. Plastic and nylon cylindrical pens (15 cm in diameter, 35 cm high) containing D. magna were suspended at four stations in the pond, each of which was treated with one of the following doses: 0 (control), field dose (2.2 kg/ha), 10x field dose, and 100x field dose. Population samplings were made on days 2, 4, and 8 after herbicide application. Herbicide treated D. magna populations showed no differences from control populations for all doses and exposure times examined (92-100% survival rate). The high survival rates of D. magna exposed to Roundup suggest that this herbicide had no detectable effect on this organism. (Geiger-FRC)
W81-00435

RELATIONSHIP OF PER CENT MORTALITY OF FOUR SPECIES OF AQUATIC BIOTA FROM 96-HOUR SEDIMENT BIOASSAYS OF FIVE LAKE MICHIGAN HARBORS AND ELUTRIATE CHEMISTRY OF THE SEDIMENTS,
Aqua Tech Environmental Consultants, Inc., Melmore, OH.
R. A. Hoke, and B. L. Prater.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 394-399, September, 1980. 4 Fig, 10 Ref.

Descriptors: *Biota, *Lake Michigan, *Sediments, *Mortality, Chemical analysis, Bioassay, Correlation analysis, Chlorides, Ammonia, Nickel, Aquatic life, Daphnia, Sampling, Dredging, Waste disposal, Toxicity.

Sediment grab samples were collected from five Lake Michigan harbors and were analyzed using bulk and elutriate chemical techniques as well as 96-hour sediment bioassays on four aquatic species. Bivariate correlations between the percent mortalities of Pimephales promelas, Hexagenia limbata, Lirceus fontinalis, and Daphnia magna and elutriate chemical data were performed by computer analysis. Of 60 bivariate correlation analyses conducted, 4 met the criteria established to identify a relevant correlation ($r = or > 40$, $p = 0.05$). The mortality of P. promelas was significantly correlated with the elutriate levels of chloride, and the mortality of H. limbata was significantly correlated with the elutriate levels of chloride, ammonia, and nickel. Previous investigations have shown greater numbers of significant correlations between mortality of test organisms and bulk chemistry of the sediments, suggesting that bulk sediment chemistry and bioassays may be more appropriate in assessing the impact of dredged material disposal on benthic species. (Geiger-FRC)
W81-00436

MASS FRAGMENTOGRAPHIC DETERMINATION OF POLYMETHYLNAPHTHALENE AND POLYMETHYLPHENANTHRENE IN A CRUDE OIL AND IN MARINE ORGANISMS,
Hyogo Prefecture Public Health Inst., Kobe (Japan).
For primary bibliographic entry see Field 7B.
W81-00437

***TOXICITY OF A FUEL OIL TO THE EGGS OF* PARHYALE HAWAIENSIS AND AMPHITHOE VALIDA (AMPHIPODA),**
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
W. Y. Lee, and J. A. C. Nicol.
Marine Environmental Research, Vol 3, No 4, p 297-305, September, 1980. 3 Fig, 1 Tab, 22 Ref.

Descriptors: *Amphipoda, *Oil, *Embryonic growth stage, *Juvenile growth stage, Toxicity, Growth stages, Mortality, Aquatic animals, Crustaceans, Water pollution, Oil pollution, Marine animals.

The toxicity of fuel oil to developing embryos and juveniles was studied in two marine amphipods, Parhyale hawaiensis and Amphithoe valida. Eggs of P. hawaiensis were selected at both early and late embryonic stages. Four concentrations (10, 20, 30, and 40%) of the water-soluble fraction (WSF) of No. 2 fuel oil were tested. For studies with A. valida, females bearing eggs in an early stage of development were exposed to concentrations of 10, 20, and 30% WSF. After 5 days, the females were sacrificed and the eggs examined for any changes indicative of fuel-oil toxicity. Eggs of P. hawaiensis were able to develop from early germinal disc stage to juvenile form in concentrations of WSF up to 40%. Among early eggs, there was greater mortality of embryos in WSF concentrations of 10-30% ($p < 0.01$); among late eggs, survival of embryos and juveniles was much greater (75% of eggs in 40% WSF hatched). However, compared with the control, there was a reduction in survival of late eggs at 30 and 40% WSF ($p < 0.01$). Juveniles hatched from early eggs died, mortality increasing with 20% WSF and above, and, at 40% WSF, no early eggs hatched. Toxicity varied with concentration and length of exposure. All young in 30 and 40% WSF died within 7 to 8 days. For studies with A. valida, toxicity was high at 20% concentrations and all embryos were killed at 30% WSF. It is suggested from these results that crustacean eggs enclosed in hard cases or shells may be more resistant to toxic petroleum oils than eggs surrounded only by fertilization and jelly membranes. (Baker-FRC)
W81-00440

EFFECTS OF PRUDHOE BAY CRUDE OIL CONTAMINATION ON SEDIMENT WORKING RATES OF ABARENICOLA PACIFICA,
Battelle Pacific Northwest Lab., Sequim, WA. Marine Research Lab.
J. M. Augenfeld.
Marine Environmental Research, Vol 3, No 4, p 307-313, September, 1980. 3 Tab, 1 Fig, 10 Ref.

Descriptors: *Sediment transport, *Oil pollution, *Feeding rates, *Indicators, *Worms, Turnovers, Sea water, Laboratory tests, Environmental effects, Organic compounds, Water pollution sources, Intertidal areas, Aquatic animals, Water pollution control.

The effect of sediment containing 250, 500, or 1,000 ppm Prudhoe Bay crude oil on the rate of feeding as measured by fecal production by lugworms (Abarenicola pacifica) was tested. Both lugworms and sediment were collected from the high intertidal region of an almost-enclosed lagoon adjacent to Sequim Bay, Washington. At oil concentrations of 500 and 1,000 ppm, the rate of feeding was reduced by 70%. Mean fecal production per unit body weight was moderately depressed in groups exposed to 250 ppm crude oil. Under normal conditions, smaller animals have higher rates of defecation than larger animals. The test results suggest that defecation rates may have potential application as an indicator of levels of environmental stress, and that under conditions of moderate pollution, lugworms may aid in recovery of intertidal zones by maintaining sediment transport through feeding activity. (Titus-FRC)
W81-00441

MICROBIOLOGY OF A PESTICIDE DISPOSAL PIT,
Iowa State Univ., Ames. Dept. of Bacteriology.
For primary bibliographic entry see Field 5E.
W81-00455

EVALUATION OF PENTRON D-90 TOXICITY TO JUVENILE ESTUARINE FISH AND BLUE CRABS,
Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Research Lab.
D. T. Buton.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 470-476, September, 1980. 4 Tab, 8 Ref.

Descriptors: *Crabs, *Fish, *Estuaries, *Sulfates, Toxicity, Powerplants, Industrial wastes, Iron, Aquatic animals, Bioassay, Water pollution, Effluents, Corrosion control, Aquatic envirnment.

Pentron D-90 is a low molecular weight polyacrylamide-based ferrous sulfate compound which is pending patent for use as a retardant of condenser tube corrosion in stream electric generating facilities. To provide baseline data on the possible toxicity of Pentron D-90 to estuarine organisms, 96-hr static bioassays were conducted on two species of crabs (Leiostomus xanthurus and Callinectes sapidus) and a juvenile Atlantic menhaden (Brevoortia tyrannus) from the Patuxent River, Maryland. A maximum Penton D-90 concentration of 5 mg/liter, similar to actual use levels, in filtered Patuxent River water was tested, since the entire compound and its derivatives will eventually be discharged into the aquatic environment. Result showed that Pentron D-90 was not toxic to juvenile Atlantic menhaden fish or crabs over a 96-hr period at the dose level tested. Calculation of total iron present in the test tanks throughout the 96-hr period indicated that no toxicity from ambient iron combined with iron released from Pentron D-90 would be expected to occur under the buffered conditions of normal estuaries. It was concluded that a Pentron D-90 discharge level of 5 mg/liter proposed for use in electrical plants would pose no harmful effects on estuarine crabs or fish. (Geiger-FRC)
W81-00456

ALGAE AS A CHEMICAL SPECIATION MONITOR-I A COMPARISON OF ALGAL *GROWTH AND COMPUTER CALCULATED* SPECIATION,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Chemistry.
R. D. Guy, and A. R. Kean.
Water Research, Vol 14, No 7, p 891-899, July, 1980. 6 Fig, 4 Tab, 43 Ref.

Descriptors: e, Phytotoxicity, Algal toxins, Monitoring, Speciation, Separation techniques, Growth rates, Aquatic environment, Laboratory tests, Computer models.

Heavy metals in the aquatic environment include metals in sediment, metals in suspended particulate or in solution, and metals absorbed onto hydrous oxide and humic colloids. Metals in true solution may be subdivided into free species, inorganic complexes, and complexes with naturally occurring ligands. Chemical speciation of metals is important in analytical and geochemical studies and especially in toxicity studies. Speciation may be studied by electrochemical methods, kinetic differences between complexes, or separation and determination of the metal content of each fraction. An alga, Selenastrum capricornutum, was used as a monitor to examine the relationship between toxicity and metal speciation. Two aspects of the effect of algae on copper speciation were studied in two separate experiments. In the first experiment, glycollic acid was used to complex the added copper, while in the second, the soluble copper/particulate ratio was found by centrifugation of algal suspensions containing different copper/ligand combinations. Increases in copper levels caused decreases in the algal growth rate as measured by chlorophyll fluorescence that were constant during a 24-hr experiment. Solutions containing ethylenediaminetetraacetate, triethylenetetraamine,

nitrilotriacetic acid, and bicine were toxic to algae at a pCu of 8.0. Solutions containing citric acid and ethylene-diamine became algicidal at pCu 9.5 and 8.65, respectively. A comparison of growth and computer-calculated speciation indicated that the copper ethylenediamine complex Cuen(2+) and the copper hydroxide-citric acid complex CuOH-cit(2-) were toxic species to algae. (Geiger-FRC)
W81-00494

5D. Waste Treatment Processes

THE COLLECTION, TREATMENT, AND DISPOSAL OF FARM WASTES,
Thames Water Authority, London (England). Conservancy Div.
R. P. Wheeler.
Effluent and Water Treatment Journal, Vol 20, No 8, p 386-390, August, 1980. 2 Fig, 2 Tab, 9 Ref.

Descriptors: *Farm wastes, *Domestic animals, *Organic wastes, *Oxidation, *Waste disposal, Sewage treatment, Slurries, Poultry, Methane, Cattle, Sewage lagoons, Farm lagoons, Odor, Recycling, Aeration, Spraying, Flocculation, Sludge disposal.

Several of the simpler methods of dealing with solid and liquid waste from cattle, pigs, and poultry are discussed. Labor difficulties and the problem of obtaining suitable litter for deep bedding have led to most farms converting to the slurry disposal system, which may be highly mechanized. Reception of waste is usually in a small tank for the initial separation of gross solids, followed by overflow to storage and/or treatment. Treatment is aimed at limiting odor nuisance during storage and disposal to the land and may take one of three forms: the oxidation-ditch system, usually with a paddle-wheel aerator, oxidation in tanks or lagoons with aeration via vanes or propellors, or the barrier-ditch system (for the brown water resulting from the final washing down of cowsheds, yards, and dairies). For pigs, attention is being focused on in-house treatment, usually by means of underfloor oxidation; a chemical flocculation process has reduced BOD from 40-200 to 10 mg/liter and suspended solids from 100-250 mg/liter to 0. The trend in the treatment of poultry waste is toward in-house drying. For the storage of slurry, either prefabricated cylindrical tanks or earth lagoons are used. Largely liquid effluent may be disposed to the land by spreading with tankers or tractor-drawn tanks with a spreading system designed to avoid formation of aerosol sprays and consequent odor. Techniques of subsoil injection are improving. Recycling manure as animal feed, silage, and methane production are also discussed. Complete treatment of farm wastes is rarely justified, as waste should be returned to the land wherever possible. (Gish-FRC)
W81-00251

HOGSMILL VALLEY SEWAGE TREATMENT WORKS,
Effluent and Water Treatment Journal, Vol 20, No 8, p 365, 368, August, 1980.

Descriptors: *Treatment facilities, *Activated sludge, *Sludge treatment, *Settling basins, *Aeration, Biological treatment, Dewatering, Drying, Sludge disposal, Land use, Waste disposal, Waste water treatment, Municipal wastes.

The Hogsmill sewage treatment plant serving the Borough of Kingsten, England is described. The plant operates on the diffused air activated sludge principle for biological oxidation. The facility has been the site of many studies including the air drying of sludge on beds and the effects of mixtures of activated and raw sludge on digesters. Sludge air drying beds were replaced by a system of thickening and transporting digested sludge to agricultural land. The Thames Conservancy had applied an effluent standard to the Hogsmill plant but this was abandoned to initiate improvements at the facility to meet existing standards. In the short time of this study, flow to the plant increased from 382 to 687 liters/sec without increases in plant capacity. High nitrification has occurred in the summer but the quality of final effluents have been generally maintained. Re-aeration channels have been remodeled for use as aeration channels. Changes in sludge withdrawal from final tanks have cut pump running expenses. Retention times for primary sedimentation tanks, aeration channels and final tanks are given. Costs of plant operation have risen dramatically in recent years. Automation is seen as the only solution in the near future to cover emergency and odd-shift labor demands of the Hogsmill facility. (Geiger-FRC)
W81-00252

ZERO DISCHARGE: IT WASN'T A COSTLY PIPEDREAM FOR ONE WATERWORKS,
American City and County, Vol 95, No 8, p 65-66, August, 1980. 3 Fig.

Descriptors: *Treatment facilities, *Coagulation, *Flocculation, *Filtration, *Zero discharge, Water treatment, Recycling, Sludge treatment, Drying, Settling basins, Costs, Installation costs, Operating costs, Seasonal, Water reuse, Municipal water, Dewatering, Chemical degradation, Potable water.

Zero discharge has been achieved at low cost by the Huntsville, Alabama water treatment plant after 18 months of operation. The plant's $4.3 million, 8.0 mgd expansion included a closed-loop filter backwash water recycling system, on-site drying beds for sludge dewatering, and on-site pit sludge disposal. Installation costs were $800,000, operation and maintenance costs were $3,000 for 1979, and sludge handling debt service was $60,000. Sludge disposal and dispersal cost $90/ton in 1979, much lower than for comparable plants. The treatment system at Huntsville includes rapid mixing, alum coagulation, flocculation/sedimentation, dual-media filtration, and chemical addition. The facility has a 2.0 million gallon underground reservoir. Filtration is high rate (60 gpm/sq ft, one filter; 4.0 gpm/sq ft, all filters). The plant is operating excellently with regard to turbidity and pH. The zero discharge system consists of liquid recycle back to the headworks and disposal of solids on site. Disposing of backwash water wastes about 2% of all treated water in a plant; thus this much is saved by recycling. Recycling backwash water also requires less horsepower to pump back through the plant than does raw water. Leopold units that float on the surface of the sedimentation basin remove sludge by siphoning. Their cost was about half that of a conventional sludge removal system. Ways of improving sludge handling in winter are being sought, as sludge production is 325 pounds/million gallons during this season compared with 100 pounds/million gallons in summer. (Gish-FRC)
W81-00257

OLD WATER SYSTEM GETS NEW LIFE,
E. Bilodeau.
American City and County, Vol 95, No 2, p 67-69, February, 1980. 3 Fig.

Descriptors: *Treatment facilities, *Flocculation, *Settling basins, *Filtration, *Lead, Waste water treatment, Costs, Control systems, Recycling, Leaching, Toxicity, Pollutants, Pipes, Chemical degradation, Municipal water, Water reuse, Potable water.

Prior to improvements made in the water system, the water in Bennington, Vermont, contained lead levels five times higher than what is considered safe, and 2,000 of the town's 10,000 residents succumbed to a waterborne disease. A 3 mgd water storage tank, a pumping station, and 20,000 feet of pipeline eliminated low water pressure. A prefabricated treatment plant with two modular filter units was put on line less than 11 months after construction began. This simple filtration system provides mechanical flocculation, tube settling, and mixed media filtration in the space normally occupied by clarifiers alone. Its construction and operating costs are low, and it is very reliable. The control system operates 24 hr/day with 8 hr of supervision, and is manually monitored, which gives the operator a positive control of the plant. The Bennington plant is capable of recycling all backwash water; this both conserves water and makes discharge permits unnecessary. It is also the first water treatment plant to incorporate a chemical process that successfully reduces lead contamination to levels acceptable under federal regulations. Food-grade sodium bicarbonate (550 pounds/day) with liquid sodium hydroxide (90 dry pounds/day) is added to the water. The latter raises the pH from a low of 4.7 to 8.5, while the former provides the alkalinity necessary (25 mg/liter) to form a hard, impervious lead coating on the inside of the lead service pipes which seals the pipe from water and eliminates leaching. Lead concentrations are now approximately 0.02 mg/liter compared with 0.25 mg/liter in May 1977. (Gish-FRC)
W81-00261

CHEMICAL AND MICROBIOLOGICAL IMPACT OF SEWAGE SLUDGE ON SOIL SYSTEMS,
Cook Coll., New Brunswick, NJ. Dept. of Soils Crops.
Lowell A. Douglas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121451, Price codes: A04 in paper copy, A01 in microfiche. New Jersey Water Resources Research Institute, Rutgers University, Final completin report, October 1980, 61 p, 25 Fig, 11 Tab, 41 Ref. OWRT-A-038-NJ(3), 14-31-0001-5030.

Descriptors: Water pollution control, *Sewage sludge, Ammonia, Nitrates, *Soil chemistry, *Soil amendments, Computer models, *Organic matter, Model studies, *Soil treatment.

The organic carbon decomposition and nitrogen transformations of two sewage sludges in a sandy loam soil were studied utilizing incubation experiments at temperatures from 8 to 22 deg. C. An 'active organic carbon' fraction decomposed at a higher rate than the bulk of the organic carbon. Q10 values for organic carbon were between 1.6 and 2 and varied with sludge type and sludge/soil ratios. The decomposition of the two sludges in soil was not significantly different at field capacity or at saturated moisture conditions. A regression model in the form of an exponential function between the CO2 evolution and the factors of time, temperature and rate of carbon added was developed, with a good fit to observed values. A simulation model for the transformation of nitrogen based on first and zero order kinetics was developed for the incubation study. A convenient computer program of the IBM 360/system, CSMP, was used to solve the differential equations in the model. The test of the model on the invubation experiment proved that the model was good and powerful in estimating the nitrogen status in such systems. (Douglas, Rutgers)
W81-00275

REMOVAL OF EUTROPHIC NUTRIENTS FROM WASTEWATER AND THEIR BIOCONVERSION TO BACTERIAL SINGLE CELL PROTEIN FOR ANIMAL FEED SUPPLEMENTS: PHASE I,
Catholic Univ. of America, Washington, DC. Dept. of Biology.
B.T. DeCicco.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124042, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Center, University of the District of Columbian, Washington, DC. Report 14, November 1977. 2 Fig, 4 Tab, 6 Ref. OWRT-A-006-DC(1).

Descriptors: *Waste water treatment, *Ammonia, *Phosphorus, Bacteris, Nitrates, Single cell protein, *Water reuse, Water pollution sources, Nutrients, Effluents, Sludge, Feeds, Biomass.

The hydrogen oxidizing chemolithotrophic bacterium Alcaligenes eutrophus has been emploed for the removal of eutrophic nitrogenous and phosphorus compounds from the final effluent and digester elutriate from the Blue Plains Wastewater Treatment Plant, Washington, D.C. Average removal levels from final effluent were 98% for ammonia, 67% for nitrate, 93& of TKN and 84% for total phosphorus. Mixtures of 1 part elutriate to

3 parts effluent yielded 88% removal of both ammonia and total phosphorus. No pretreatment of elutriate or effluent was necessary to support groth, and sterilization of wastewater samples yielded results similar to unsterile samples; i.e., the chemolithotroph need not be grown in pure culture. A hydrogen oxidizing chemolithotroph different from A. eutrophus has been isolated from Blue Plains final effluent and has been classified as a member of the genus Pseudomonas.
W81-00276

REMOVAL OF EUTROPHIC NUTRIENTS FROM WASTEWATER AND THEIR BIOCONVERSION TO BACTERIAL SINGLE CELL PROTEIN FOR ANIMAL FEED SUPPLEMENTS: PHASE II,
Catholic Univ. of America, Washington, DC. Dept. of Biology.
B. T. DeCicco.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124059, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Center, University of the District of Columbia, Washington, D.C. Report 15, April 1979. 14 p, 4 Tab, 9 Ref. OWRT-A-006-DC(2).

Descriptors: *Wastewater treatment, *Ammonia, *Phosphorus, *Bacteria, Single cell protein, *Water reuse, Water pollution sources, Effluents, Nutrients, Microorganisms, Sludge, Feeds, Biomass.

The bacterium Alcaligenes eutrophus was grown in phosphorus supplemented digestor elutriate from the Blue Plains Wastewater Treatment Plant using a microbial fermentor. Gaseous hydrogen, oxygen and carbon dioxide were supplied as carbon and energy sources. Ammonia and phosphate removal averaged 87% and 93%, respectively, at the time of cell harvest. The cellular biomass was washed, dried, chemically analyzed and employed as the protein component of check diets. The biochemical composition of the wastewater grown biomass was 8.7% RNA, 1.3% DNA, 56% protein, 3.2% carbohydrate, and 30.8% lipid and inert materials. Chick feeding experiments demonstrated that the bacterial biomass had a protein quality of 88% compared to reference casein. In sterilized samples of sludge: effluent at dilutions of 1:4, 1:8 and 1:20 under a H2, O2CO2 atmosphere, growth of A. eutrophus was substantial and was proportional to the sludge concentration, reaching 8 x 10 to the ninth power organisms/ml in the 1:4 mixture. When the gas atmosphere was replaced by air, growth was substantially less. Chemical analyses of the treated mixtures showed 89-92% ammonia removal and 98-99% phosphate removal from gassed cultures. Cultures incubated under air showed increases in ammonia levels of 25-67% and phosphate reductions of approximately 90%. The bacterial system employed in these studies appears to be an efficient means of removing nitrogenous and phosphorus pollutants from final effluent, digester elutriate and undigested sludge resulting from wastewater treatment. The bacterial biomass produced during elutriate treatment appears to possess high nutritive value as a protein source for chick feed.
W81-00277

REMOVAL OF EUTROPHIC NUTRIENTS FROM WASTEWATER AND THEIR BIOCONVERSION TO BACTERIAL SINGLE CELL PROTEIN FOR ANIMAL FEED SUPPLEMENTS: PHASE III,
Catholic Univ. of America, Washington, DC. Dept. of Biology.
B. T. DeCicco.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124067, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Center, University of the District of Columbia, Washington, D.C. Report 16, April 1980. 13 p, 2 Fig, 3 Tab, 9 Ref. OWRT-A-006-DC(3).

Descriptors: *Wastewater treatment, *Ammonia, *Phosphorus, *Bacteria, Single cell protein, Water reuse, Water pollution sources, Nutrients, Effluents, Sludge, Feeds, Biomass.

We previously have demonstrated that the bacterium Alcaligenes eutrophus is an efficient and effective remover of nitrogenous and phosphorus compounds from municipal wastewaters. Further, the biomass generated from growth on wastewater proved to be a source of high quality protein for the growth of chickens. During this phase a quantity of biomass grown in the fermentor on digester elutriate was treated with a variety of conditions in order to find conditions which promoted cellular aggregation, since this would allow easier separation of cellular biomass from the treated wastewaters. Two treatments produced sedimentation of the cells: either addition of alkali to pH 11 or the addition of an anionic exchange resin (Cellex-D) produced aggregation of the biomass and clarification of the wastewaters. Elutriate samples that were unheated and then inoculated with A. eutrophus yielded little growth, while samples heated to 50 and 70 deg. C produced cell densities that were 74% and 94% respectively, as high as a sample sterilized by autoclaving. Thus a heat labile inhibitor of A. eutrophus was present in elutriate. Samples of digester elutriate, secondary digested sludge and primary undigested sludge were analyzed for the presence of mutagenic substances using the Ames Salmonella mutagenicity test. Samples were assayed both with and without metabolic activation with rat liver S-9 mix. Tests were negative with all samples and bacterial strains with the possible exception of a marginally positive response with both sludge and elutriate samples tested with strain TA 1537.
W81-00278

GAS TREATMENT OF LIQUID,
Stamicarbon, BV., Geleen (Netherlands). (Assignee).
F. J. Fontein, and H. F. Jennekens.
U.S. Patent No. 4,189,384, 6 p, 3 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 991, No 3, p 990, February 19, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Aeration, Biological treatment, Jets, Equipment.

The purpose of the invention is to achieve improved aeration of waste water in biological purification installations, to keep the water in the basin in motion, and not to damage substances that are present in the liquid. Gas is supplied under pressure to a generally bell-shaped chamber placed below the surface of a body of wastewater to form a gas space in the chamber. A stream of liquid is introduced into the gas space in the form of at least one liquid jet which passes through the gas space and into the liquid to drive gas into the liquid. The chamber is effectively placed one to several meters below the water surface. The water jets may be formed with the aid of a horizontal feed tube provided with one or more outlet apertures which face downwards at a slant. (Sinha-OEIS)
W81-00372

WASTE WATER TREATMENT,
Amax, Inc., Greenwich, CT. (Assignee).
J. M. Laferty, G. G. Van Riper, and W. P. Zundel.
U.S. Patent No 4,189,381, 6 p, 1 Fig, 4 Tab, 5 Ref; Official Gazette of the United States Patent Office, Vol 991, No 3, p 989, February 19, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial waters, Molybdenum, Heavy metals, Separation techniques, Ion exchange, Chemical precipitation, Flocculation, Electrolysis, Foam separation, Cyanides.

The invention relates to the treatment of industrial waste water for recycling to surface waters and to the treatment of waste water obtained in mineral recovery processes, such as in the flotation recovery of molybdenite. Waste water containing over 2 ppm Mo and at least one heavy metal impurity selected from the group consisting of Fe, Mn, Cu, Zn, Pb, and Cd, and also containing cyanide ion (CN) is treated by passing waste water having an adjusted pH value ranging from about 3 to 4 through an ion-exchange resin column selective to the removal of Mo and provide an ion-exchange effluent containing at least one of the heavy metal impurities and the cyanide ion. The pH value of the effluent is then adjusted to a range of about 7 to 11 sufficient to precipitate the heavy metal impurity having the highest pH requirement for precipitation. The precipitate is flocculated and the effluent containing the flocculated precipitate is subjected to electrolysis using insoluble electrodes to form electroflotation of the flocculated precipitate to form a froth which is separated from the effluent by skimming. (Sinha-OEIS)
W81-00374

BIOLOGICAL TREATMENT AND TOXICITY STUDIES,
Beak (T. W.) Consultants Ltd., Vancouver (British Columbia).
Environmental Protection Service, Ottawa, Ontario, Canada, Water Pollution Control Directorate. Economic and Technical Review Report EPS 3-WP-73-6, 1973. 64 p, 51 Fig, 14 Tab, 27 Ref, 7 Append.

Descriptors: *Alberta, *British Columbia, *Aerated lagoons, *Biological treatment, Kraft mills, Mathematical modelling, Effluents, Testing, Evaluations, Heat loss, Data collection, *Waste water treatment, Lagoons, Canada.

The results of a comprehensive survey of three aerated lagoons treating kraft mill effluents in Western Canada are presented. Each lagoon is provided with surface mechanical aeration and has a residence time of five days. Long term operating data for each system is reported including summer and winter BOD removal efficiencis, aerator loadings, and oxygen transfer efficiencies. Consieration was given to start-up procedures, temperature losses through the lagoon, optimum nutrient additions, pH effects, quiescent zones, and sludge accumulations. A detailed investigation of the overall mixing conditions in an aerated lagoon was made using Fluorescent tracer techniques. Lagoon geometry was more important than aeration horsepower in determining the mixing characteristics. Mathematical mixing models were developed for each system and are useful both for aerated lagoon performance prediction and for aerated lagoon design. (WATDOC)
W81-00389

ON-SITE TREATMENT FOR LOW-DENSITY AREAS,
American City and County, Vol 95, No 4, p 45-48, April, 1980. 2 Fig, 1 Tab.

Descriptors: *Domestic wastes, *Waste treatment, *Sewerage, Septic tanks, Sewage disposal, Waste disposal, Costs, Sand mounds, Leaching, Absorption, Anaerobic digestion, Sewage lagoons, Filters, Evapotranspiration.

Various means for achieving on-site treatment of household wastes are explained. EPA figures indicated that, in 1978, 32% of the population in the U.S. was not served by primary, secondary, or advanced waste treatment facilities. The septic tank/leaching field is suitable where soils have a percolation rate no faster than 0.1 min/inch and no slower than 60 min/inch. High seasonal water table areas must be avoided. Elevated sand mounds may be used in soils that cannot support an absorption field. Mounds must be shaped and located to function according to effluent flows and topography. They must not be located on slopes of > 12%. For a standard three-bedroom home with an estimated flow of 450 gpd, a mound with a base area of 7,200 sq ft is needed. Aerobic and anaerobic lagoons may also be used to catch septic tank effluent. In some places, such lagoons have met the 30/30 BOD suspended solid standard most of the year. Evapotranspiration beds have worked well in cold weather regions. However, in other areas, continual surface overflowing has caused problems. Sand filters can cost $3,000-$4,000 and are of two types, intermittent and recirculating. Non-soil-dependent on-site systems usually consist of small, aerobic package units and one of the treatment/disposal options associated with septic tanks. (Baker-FRC)
W81-00419

EBMUD: AWARD WINNING SEWAGE WORKS,
American City and County, Vol 95, No 6, p 47-49, June, 1980. 6 Fig.

Descriptors: *Activated sludge, *Chlorination, *Sewage treatment, *Water reuse, *Oxygen activated sludge, Anaerobic digestion, Pumps, Pacific Coast Region, Recycling, Treatment facilities, Industrial water, Industrial wastes, Domestic water, Oxygen, Disinfection, Water purification, Reclamation, Waste water treatment, Nitrification.

The first large-scale pure oxygen activated sludge secondary treatment system in California is discussed. This facility, located in the East Bay Municipal Utility District in Oakland, meets federal and state requirements for discharges to San Francisco Bay and also reclaims up to 1.0 mgd of treated effluent for in-plant use. Both domestic and industrial waste water are treated for an area of 83 sq miles and for 600,000 people. Primary treatment, effluent disinfection, and water reclamation for in-plant use are discussed. A UNOX high-purity oxygen activated sludge system provides secondary treatment for the plant's 71 mgd of waste water. This process has a peak hydraulic capacity of 168 mgd. A three-stage open-top nitrification tank with fine bubble diffusion of high-purity oxygen is used to polish secondary effluent to produce the industrial grade water. (McKeon-FRC)
W81-00421

LEACHATE CONTROL DOESN'T COME EASY,
American City and County, Vol 95, No 5, p 69-72, May, 1980. 3 Fig, 1 Tab.

Descriptors: *Leachate, *Landfills, *Water pollution control, *Waste disposal, Waste water, Sewage treatment, Drainage systems, Waste treatment, Runoff, Groundwater, Percolation, Recycling, Legislation, Sewerage, Waste water treatment.

Sanitary landfills almost always produce leachate, and BOD, COD, suspended solids, and turbidity are much greater in leachate than in raw municipal waste water. In addition, the former often also has low pH, low dissolved oxygen, toxic chemicals, and heavy metal ions. Leachate treatment systems range from those based entirely on soil attenuation to a complex chain of physical-chemical and biological steps. Collection systems generally depend either on a relatively impermeable natural clay liner or on an artificial membrane at the bottom of the fill. Runoff should be diverted into drainage channels, and slopes of 3-5% are recommended. The Henrico County, Virginia landfill has no artificial liners, collection mechanisms, or treatment systems; ground- and surface water is diverted round the site, all leachate will move to a treatment zone before discharge, there will be four or six leachate flow-through impoundments, and the site accepts no industrial or hazardous wastes or sewage sludge. In Montgomery County, Pennsylvania, leachate recycling has been practiced for the last 5 yr with moderately good results. In Wisconsin, some fills discharge leachate directly into sewage systems with no ill effects, and fills have been placed below the zone of saturation without groundwater contamination (clayey soils are particularly suitable); also, a law requiring treatment of leachate 20-30 yr after site closure is in effect. Percolation must be reduced, and a means of forecasting the amount and type of leachate that will be produced in the long term must be devised. (Gish-FRC)
W81-00423

REMOVAL OF NITROGEN FROM INDUSTRIAL WASTE WATERS BY BIOLOGICAL NITRIFICATION-DENITRIFICATION,
Degremont S.A., Rueil-Malmaison (France).
M. A. Picard, and G. M. Faup.
Water Pollution Control, Vol 79, No 2, p 213-224, 1980. 5 Fig, 4 Tab, 10 Ref.

Descriptors: *Nitrification, *Denitrification, *Biological treatment, *Industrial wastes, Sludge treatment, Nitrogen-fixing bacteria, Waste water treatment, Water pollution sources, Fertilizers, Explosives, Chemical wastes, Nutrients, Carbon, Equipment.

The level of nitrogen in industrial waste waters depends upon the type of industry which produces the pollution. Considerable variations in the nitrogen levels of effluents from different industries are found, with highest concentrations being produced during the manufacture of nitrogen-based fertilizers, gunpowder and explosives, and chemicals. More than 90% of the nitrogen contamination may be removed from industrial effluents by nitrification-denitrification techniques. Precautions must be taken to ensure that the influent contains no products that are harmful to the nitrification process. At the Hoechst Cuise Lamotte plant in France, nitrification was halted for three weeks when a product toxic to nitrifying bacteria was discharged. An external source of carbon may be needed to allow denitrification to proceed depending upon the effluent composition. Single-, two-, or even three-sludge systems may be used depending on whether treatment of carbonaceous pollution, nitrification, and denitrification are to be kept as separate processes or combined. In a single-sludge system, the anoxic tank will remain at the inlet, while in the two-sludge system based on nitrification in the first tank, denitrification will be carried out in a separate tank, yielding savings in the size of tanks required. However in the two-sludge system, the problems connected with precise dosing of organic carbon pose a severe limitation. Good results are obtained with the single-sludge process without the need of a sophisticated method of organic carbon addition. (Geiger-FRC)
W81-00425

THE EFFECTS OF NITRATE CONCENTRATION AND RETENTION PERIOD ON BIOLOGICAL DENITRIFICATION IN THE ROTATING-DISC SYSTEM,
Stuttgart Univ., (Germany, F.R.).
P.-S. Cheung, and K. Krauth.
Water Pollution Control, Vol 79, No 1, p 99-105, 1980. 6 Fig, 2 Tab, 8 Ref.

Descriptors: *Nitrification, *Denitrification, *Waste water treatment, Biological treatment, Sewage treatment, Sludge treatment, Sewage bacteria, Nitrates, Rotating disc system, Anaerobic conditions, Alcohols, Effluents.

Rotating disc systems (RDS) have been used successfully to remove oxidized nitrogen compounds from waste water by biological denitrification. This requires a carbon source, appropriate bacterial populations, and anaerobic conditions. The influence of retention period and nitrate levels on the denitrification process in an RDS were studied at 20-22 C and pH 7-8. The RDS used was 1.0 m in diameter and had an area of 14.97 sq m. The rotation speed was 3.23 rpm for each phase of a two-part experiment. During the first phase, the retention periods and nitrate loadings were varied, while in the second phase, retention periods were varied and nitrate loadings were kept constant. Nitrate nitrogen, nitrite nitrogen, ammoniacal nitrogen and residual methyl alcohol were determined in filtered samples daily. BOD and sludge production were analyzed at the end of each experiment. Results showed that the denitrification rate and sludge production are linear functions of nitrate loading. Within a nitrate loading range up to 18.85 g/sq m/day, a first order reaction took place for denitrification in the RDS with respect to nitrate levels in the influent. An optimum hydraulic retention period of 1.5 hr was recommended. The solids retention period was also found to be a linear function of nitrate loading as well as of the hydraulic retention period. Suspended solids in the effluent (wasted sludge) could not be regulated in the RDS; therefore a system with a larger disc is recommended to provide a higher solids retention period to yield greater stability and flexibility during the denitrification process. (Geiger-FRC)
W81-00428

EFFECT OF SYSTEMS SOLIDS RETENTION TIME (SSRT OR SLUDGE AGE) ON NITROGEN REMOVAL FROM ACTIVATED-SLUDGE SYSTEMS,
Toronto Univ. (Ontario).
P. H. Jones, and H. M. Sabra.
Water Pollution Control, Vol 79, No 1, p 106-116, 1980. 13 Fig, 8 Tab 28 Ref.

Descriptors: *Waste water treatment, *Denitrification, *Nitrification, *Sludge treatment, Biological treatment, Nitrates, Heavy metals, Toxins, Sludge age, Suspended solids, Dissolved oxygen, Nitrogen, Domestic wastes, Oxidation, Alkalinity.

Many biological processes have been developed for the reduction of nitrogen in waste water treatment. One theory proposed that the solids retention time (SRT) governed the kinetics of the biological treatment processes. The quality of the effluent, volatile suspended solids, and oxygen demands were shown to be a function of sludge age. Nitrification requires dissolved oxygen (DO) to complete the oxidation of nitrogen, while denitrification calls for a suitable environment for the reduction of nitrate to nitrogen gas. Other factors affecting nitrification are pH, alkalinity, DO levels and the presence of heavy metals or toxic substances. The effect of systems SRT (SSRT or sludge age) on total nitrogen removal was evaluated at 7, 15, and 25C. Results showed that at a constant temperature, increasing the SSRT increases the total nitrogen removed from the system. Almost complete nitrogen removal occurred with SSRT values of 3 days at 25C, 6 days at 15C, and 20 days at 7C. The rate of ammoniacal nitrogen oxidation increased with increasing sludge age. Results of the present study agreed well with the Marais equation for predicting minimum sludge age required to achieve complete nitrification at different temperatures. The assumption of zero-order reaction for both nitrification and denitrification rates proved valid for the levels of nitrogen commonly present in domestic waste water. (Geiger-FRC)
W81-00429

POSSIBLE EFFECTS OF PHOSPHORUS ON ALGAL GROWTH IN BARTON BROAD AND RELATED CONTROL MEASURES,
Anglian Water Authority (England). Norfolk and Suffolk River Div.
For primary bibliographic entry see Field 5C.
W81-00430

MICROSCSREENS POLISH LAGOON EFFLUENT,
M. E. Harrelson.
American City and County, Vol 95, No 5, p 75-77, May, 1980. 2 Fig.

Descriptors: *Sewage lagoons, *Chlorination, *Screens, *Waste water treatment, Biological oxygen demand, Suspended solids, Algal control, South Carolina, Ponds, Control systems, Oxidation lagoons, Effluents, Sewage treatment, Costs, Construction costs, Municipal wastes.

zn overloaded lagoon in Camden, South Carolina was upgraded by the installation of ultrafine screens. Tests showed that microscreens with one miczometer polyester media could effectively screen out algal solids from oxidation pond effluents without the use of chemicals and at the same time maintain secondary treatment standards in the effluent. During a 24-hr pilot test, the microscreen reduced the average influent suspended solids from 128 ppm to 19 ppm and average BOD from 37 ppm to 16 ppm. Average flow rate through the screen was 2.0 gpm/sq ft of new effective submerged area. The new facility includes a mechanically cleaned bar screen followed by two 15-acre oxidation ponds. The first pond has three plug-flow aeration cells created with floating aerators and curtain partitions. Pond effluent is lifted to the microscreens by variable speed screw pumps. Six 10 ft x 16 ft microscreens remove the algae. Screen effluent is then chlorinated and discharged. Piping and valving will allow parallel, series, or single cell operation of the lagoons. This facility will be the first completely automatic microscreen operation using on-line suspended solids monitoring and process control. The construction

contract costs for this facility was $2.3 million, or $1.22/gal of plant capacity compared with $2.14/gal of plant capacity for a conventional activated sludge facility. (McKeon-FRC)
W81-00432

PLANNED PROCESSING BEATS BACK WATER-PLANT SLUDGE DISPOSAL PROBLEMS,
Pirnie (Malcolm), Inc., Paramus, NJ.
For primary bibliographic entry see Field 5F.
W81-00438

BACTERIAL DIE-OFF AND STREAM TRANSPORT STUDIES,
Canada Centre for Inland Waters, Burlington (Ontario).
B. J. Dutka, and K. K. Kwan.
Water Research, Vol 14, No 7, p 909-915, July, 1980. 5 Fig, 5 Tab, 11 Ref.

Descriptors: *Disinfection, *Chlorination, *Pathogenic bacteria, *Waste water treatment, Aquatic bacteria, E. coli, Salmonella, Streptococcus, Streams, Lake Ontario, Mutagens, Carcinogens, Tracers, Mortality, Public health, Water pollution sources, Sewage effluents.

The effects of chlorination and other disinfection processes on aquatic life exposed to low residual levels have become important with regard to possible mutagenicity and carcinogenicity of these compounds. Two experiments using bacteria as indicator organisms to monitor levels of residual disinfectants from waste water treatment processes are reported. An investigation was made of the rate of transport and survival period of Serratia marcescens in a small Canadian stream, while a second study examined the die-off rate of E. coli, Streptococcus faecalis, and Salmonella thompson in membrane filter chambers in Lake Ontario and Hamilton Bay. Results showed recovery of S. marcescens up to 22 days. This bacterium was also traced for a distance of 20 km. Survival studies of indicator organisms and pathogens in Hamilton Bay and Lake Ontario resulted in a minimum survival for all three organisms of 28 days. E. coli displayed a much slower die-off rate than S. faecalis, suggesting that infrequent point discharges of fecal matter had a possible cumulative effect which would promote the growth of pathogens and pose a threat to health. Complete removal of viable microorganisms by sewage treatment processes may be necessary before any consideration is given to the elimination of disinfection procedures. (Geiger-FRC)
W81-00492

REMOVAL OF ORGANICS IN WATER USING HYDROGEN PEROXIDE IN PRESENCE OF ULTRAVIOLET LIGHT,
Health and Welfare Canada, Ottawa (Ontario). Monitoring and Criteria Div.
For primary bibliographic entry see Field 5F.
W81-00498

DETERMINATION OF BIOLOGICAL REMOVAL OF ORGANIC CONSTITUENTS IN QUENCH WATERS FROM HIGH-BTU COAL-GASIFICATION PILOT PLANTS,
Argonne National Lab., IL. Energy and Environmental System Div.
V. C. Stamoudis, and R. G. Luthy.
Water Research, Vol 14, No 8, p 1143-1156, August, 1980. 5 Fig, 6 Tab, 10 Ref.

Descriptors: *Organic wastes, *Coal mine wastes, *Activated sludge, Industrial wastes, Gas chromatography, Waste treatment, Mass spectrometry, Biological treatment, Aromatic compounds, Pilot plants, Organic compounds, Quenching, Phenols.

The efficiency of a bench scale, activated-sludge treatment to remove organic constituents from coal-gasification process effluents was examined. Raw gas quench waters were obtained from two gas technology pilot plants to evaluate the efficiency of biological oxidation for organic removal. Bituminous Illinois No. 6 coal was used for the HYGAS steam-oxygen process and Indian Head lignite was used for the slagging, fixed-bed (SFB) process. The biological reactors employed were complete-mix, single-stage, air-activated sludge reactors with internal clarifiers. Influent and effluent reactor samples were extracted with a methylene chloride pH-fractionation technique into acid, base, and neutral fractions. Each fraction was subjected to capillary-column gas chromatography/mass spectrometry. Almost 99% of extractable and chromatographic organic material of both HYGAS and SFB influent acid fractions consisted of phenols and alkylated phenols. These compounds were removed almost completely by activated sludge treatment. Satisfactory removal was achieved for base-reaction organics with the exception of certain alkylated pyridines. Removal of neutral-fraction organics was also good, except for certain alkylated benzenes, certain polycyclic aromatic hydrocarbons, and some cycloalkanes and cycloalkenes, especially when influent levels were low. (Geiger-FRC)
W81-00500

5E. Ultimate Disposal Of Wastes

MAKE SEWAGE A VALUABLE COMMODITY,
Westminster, CO.
For primary bibliographic entry see Field 3D.
W81-00258

SLUDGE TREATMENT VS. ENERGY CONSERVATION,
K. Grover.
American City and County, Vol 95, No 2, p 39-40, 42, February, 1980. 2 Fig.

Descriptors: *Sludge treatment, *Energy, *Heat treatment, Chemical degradation, Costs, Sewage sludge, Sewage treatment, Dewatering, Ultimate disposal, Waste water treatment, Sludge digestion, Solid wastes, Water pollution control, Treatment facilities.

Problems are experienced by communities with an abundance of 'untreatable' sludge. Sludge comprises about 50% of the total treatment cost and 90% of the problems associated with waste water treatment. Each year about 4.2 million tons of sludge are produced. This will increase to 6.7 million tons by 1985. Digestion, which was the most common treatment method, does not meet new federal standards. For sludge that would dewater easily, heat treatment was used until its cost escalated after 1972. In 1972, costs for heat and chemical treatment were about the same. In 1979, the heat treatment of sludge cost $42/ton more than chemical treatment. Odor control and the disposition of the cooking liquor are also problematic. However, wet air oxidation, a heat treatment system, is working impressively, and new ideas about the placement of the heat treatment equipment in the overall design of the system may improve efficiency. The heat treatment reactor temperature ranges from 300 to 500 F, killing viruses and rendering the sludge sterile. Heat treatment can produce a dewatered sludge cake of 30-40% solids by weight. Chemical conditioning produces a cake of 15-20% solids at a smaller loading rate on dewatering equipment. However, heat treatment can deliver smaller solids loads downstream. (Baker-FRC)
W81-00439

SEWAGE-SLUDGE INCINERATION RAISES AIR POLLUTION CONCERNS,
Environmental Protection Agency, New York.
R. T. Dewling.
Water and Sewage Works, Vol 127, No 10, p 26-29, 43, October, 1980. 4 Fig, 5 Tab, 10 Ref.

Descriptors: *Incineration, *Sludge disposal, *Air pollution, Sewage sludge, Sewage treatment, Water pollution, Heavy metals, Organic compounds, Polychlorinated biphenyls, Temperature, Particle size, Toxins, Lead, Cadmium, Ultimate disposal, Trace elements.

Compliance of sewage sludge incinerators with federal standards for emissions and opacity depends on the characteristics of the feed sludge and operating temperatures. Multiple-hearth and fluidized bed incinerators are used in the U.S. The environmental impacts of incineration include water pollution due to boiler blowdown and scrubber water discharges as well as ash handling and disposal. Most of the heavy metals found in sludge are concentrated in the ash at levels of > 1%. Poor incineration can lead to the formation of odorous, partially oxidized hydrocarbons (e.g., aldehydes, ketones) and sometimes sulfur oxides. Uncontrolled particulate emissions may vary from 4-110 kg/mg dry sludge input, depending on incinerator type and sludge composition (e.g., percentage volatile solids, moisture). Organic pollutants, including polychlorinated biphenyls, low-molecular weight hydrocarbons, and heavy metals, may be emitted if operating conditions are inadequate. EPA tests of a fluidized-bed incinerator in the New York metropolitan area indicated that, when incinerator temperatures increased from 1,200 to 1,750 F, lead emission increased 25-fold (3.1-77.0 mg/g) and cadmium increased almost 10-fold (1.0-8.1 mg/g). These increased emissions are associated with respirable particles of < 3 micrometers. The lowest possible trace metal emission would be provided by a two-stage system where the main incinerator is operated at the lowest possible temperature while an afterburner operates at a very high temperature (= or > 1,800 F). This would be followed by air-pollution control, so most of the toxic organics would be destroyed. (Gish-FRC)
W81-00442

INCINERATION IS A WASTE-MANAGEMENT ALTERNATIVE,
W. R. Niessen.
Water and Sewage Works, Vol 127, No 10, p 30-31, 49, October, 1980. 2 Fig, 2 Ref.

Descriptors: *Incineration, *Heat balance, *Waste disposal, *Temperature, *Solid wastes, Toxicity, Water pollution, Air pollution, Energy, Conservation, Costs, Heavy metals, Inorganic compounds, Gases, Sewage sludge, Dusts, Waste water(Pollution), Ultimate disposal.

Incineration as an alternative to hazardous waste management is being encouraged, even though there are operating and environmental problems associated with this method. The advantages of incineration include volume reduction, regulatory compliance, detoxification, and energy recovery, while the disadvantages are cost, operational and staffing problems, air and water pollution, public-sector reaction, and technical risk. Analysis of energy effects for most combustion systems emphasizes the benefits of concentrating combustibles. Waste combustion can produce air pollutants, but in amounts that can be anticipated. The appearance of combustible particulate in incinerator effluent reflects inadequate combustion effectiveness. Mineral particulates from incinerator stacks can become contaminated by enriched concentrations of heavy metals. The degree of concentration in the particulate relative to the bulk waste depends on the physical form of the waste and on the nature of the heavy metals. Gaseous pollutants include sulfur oxides, hydrogen chloride, and nitrogen oxides. The most important parameter for a combustor is volumetric heat release rate, and the second is peak combustion temperature. Three major residue streams are produced by an incinerator: that from the primary chamber, dusts in flues, and scrubber sludge. A waste water stream may also be produced. (Gish-FRC)
W81-00443

MICROBIOLOGY OF A PESTICIDE DISPOSAL PIT,
Iowa State Univ., Ames. Dept. of Bacteriology.
L. M. Johnson, and P. A. Hartman.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 448-455, September, 1980. 1 Fig, 2 Tab, 16 Ref.

Descriptors: *Pesticides, *Microbiology, *Bacteria, *Waste disposal, Pseudomonas, Cultures, gas chromatography, Liquid wastes, Soil microbiology, Rocks, Chlorinated hydrocarbon pesticides, Carbamate pesticides, Organophosphorus pesti-

cides, Triazine pesticides, Ultimate disposal, Underground waste disposal.

The microbiological activity of the pesticide disposal pit at Iowa State University was monitored after 8 yr of use. Pesticides disposed of in the pit included chlorinated hydrocarbons, triazines, organophosphates, and carbamates. The pit was 0.9 m deep at one end and 1.2 m deep at the other with dimensions of 9.1 m by 3.7 m. Sample pipes were placed 2 m apart along the central axis of the pit, and aqueous samples drawn from them were processed aerobically and anaerobically to evaluate microbial life. Pit soil samples were collected near each sample pipe. Submerged rocks were randomly collected from the pit and scrubbed in sterile deionized water. Rock washings were diluted and plated on peptone agar to determine viable cell numbers. Eighty-nine percent of the 119 randomly selected isolates from pit liquid were gram-negative rods. Of these, 65% were pseudomonads. Twenty-nine percent of the pit liquid isolates were unidentifiable motile, gram negative rods, while gram positive bacteris were mostly Arthrobacter (7%), Micrococcus (3%), and Streptomyces (2%). Six of 20 isolates selected on the basis of colonial morphology grew well in sterile pesticide pit liquid. Viable cells per gram of soil ranged from 400,000-630,000 on trypticase soy agar. Bacteria found in soil included the Bacillus species (50%), Pseudomonas (21%), gram-negatie rods (21%), Citrobacter (4%), and Arthrobacter (1%). Bacterial species found on rock surfaces resembled those recovered from pit soil. No pesticide-free control pit was available for comparison. Day to day fluctuations were noted in pit temperature and pH. The presence of a particular bacteria in the pit did not prove that pesticies were degraded by that organism. Gas chromatographic studies on pit liquid showed no long-term accumulation of any pesticide. (Geiger-FRC)
W81-00455

5F. Water Treatment and Quality Alteration

THE MECHANISM OF OZONE INACTIVATION OF WATERBORNE VIRUSES,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
O. J. Sproul, and C. K. Kim.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127334, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, July, 1980. 32 p, 8 Fig, 3 Tab, 38 Ref. OWRT-B-013-ME(2).

Descriptors: *Ozone, *Waste water treatment, *Water treatment, *Chlorination, *Disinfection, *Viruses, *Bacteriophage, Oxidation, Water quality, Water quality control, Odor, Treatment, Water purification, Chemical reactions, Aquatic microbiology, Diseases, Biocontrol, Infection, Microorganisms, Water pollution, Water pollution sources.

Ozone has received recent attention as an alternative disinfectant to chlorine in water and waste water treatment practices due to its more rapid powerful germicidal activity and no reported side-effects as can result from chlorination, such as taste, odor, and toxic byproducts. The present study sought to determine the ozone inactivation mechanism for viruses in water using the f2 RNA containing virus and T4 DNA containing virus bacteriophages as models. It was concluded that ozone inactivated the f2 and T4 bacteriophages by attacking capsid protein, with liberation and inactivation of the nucleic acid. RNA from f2 bacteriophage at least partially inactivated prior to release from the capsid, with the inactivation rate slower than the whole phage but faster than the naked RNA exposed to ozone. Finally, DNA released from T4 bacteriophage was rapidly inactivated by ozone at about the same rate as the intact phage. The study results suggested that the RNA of enteric viruses may retain their infectivity after liberation from the viral particle during ozonation of water and waste water, if they are inactivated by ozone in the same manner as the f2 phage. (Zielinski-IPA)
W81-00315

APPARATUS FOR CONTROLLED CHLORINATION OF WATER WITH AN ALKALI METAL DICHLOROISOCYANURATE,
FMC Corp., Philadelphia, PA. (Assignee).
C. D. Watson.
U.S. Patent No 4,181,702, 13 p, 3 Fig, 26 Ref; Official Gazette of the United States Patent Office, Vol 990, No 1, p 275, January 1980.

Descriptors: *Patents, *Water treatment, *Water purification, *Chlorination, Quality control, Disinfection, Instrumentation, Equipment.

An apparatus and method are disclosed for the controlled chlorination of a water supply in which an alkali metal salt of dichloroisocyanuric acid is dissolved to form a concentrated chlorine solution that is slowly released into the water supply. The apparatus contains an internal standpipe, open to the water supply at its bottom end and having water inlet apertures and solution metering apertures in its wall. The natural circulation of water in the sandpipe through the solid dichloroiscyanurate charge contained in the apparatus in chlorination of the water supply at a rate controlled by the size number of solution metering apertures. (Sinha-OEIS)
W81-00376

MINE DEWATERING,
For primary bibliographic entry see Field 6E.
W81-00398

THE IMPACT OF DESALTING ON WATER SUPPLY - ALAMOGORDO, NEW MEXICO,
Herkenhoff (Gordon) and Associates, Albuquerque, NM.
D. D. Jardin.
In: A Quarter Century of Water Research. Proceedings of the Twenty-Fifth Annual New Mexico Water Conference. Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 192-195. New Mexico Resources Research Institute, New Mexico State University, Box 3167 Las Cruces, NM 88003.

Descriptors: *New Mexico, *Desalination, *Water supply, *Water quality, *Construction costs, *Saline water, Planning, Legislation, Engineering, Descaling, Dissolved solids, Research and development.

Alamogordo was one of two cities selected by OWRT to have a demonstration program of desalting technology. Their water quality is good; however, the supply meeting federal standards does not meet demand, especially in midsummer. The only additional supply is groundwater. The OWRT has agreed to pay 85% of the construction costs ($13 million) for a plant capable of treating two million gallons a day. Final water approval to proceed is pending. Higher quality water improves the taste of food, reduces soap use and extends the lives of appliances. The average homeowner would save approximately $9.56 a month, or $114 a year, as a result of reduced appliance maintenance, soap use, and municipal costs. Alamogordo has the opportunity to lead the state in desalting technology, to produce high quality water and to help other communities learn how to improve their water supply. (Atkins-Omniplan)
W81-00400

DISPUTES OVER WATER QUALITY POLICY: PROFESSIONAL CULTURES IN CONFLICT, 1900-1917,
Carnegie-Mellon Univ., Pittsburgh, PA.
J. A. Tarr, T. Yosie, and J. McCurley, III.
American Journal of Public Health, Vol 70, No 4, p 427-435, April, 1980. 1 Fig, 51 Ref.

Descriptors: *Sewerage, *Public health, *Sanitary engineering, *History, Political aspects, Combined sewers, Riparian rights, Municipal water, Filtration, Economic feasibility, Water quality standards, Legislation.

A review of historical information concerning disputes between professional groups over water quality policy between 1900 and 1917 indicates that the issues have remained the same through history. The origin of the dispute concerned the health-efficacy of combined or separate sewers. The central issue was which profession was most qualified to determine public health standards and policy within the framework of municipal cost constraints. Construction of sewage systems causing deterioration of downstream water supplies resulted in a wave of legislation and numerous court cases identifying responsibilities of riparian users. Water quality enforcement was primarily entrusted to health professionals, yet included sanitary engineers. The year 1900 marked the beginning of debate between engineers and physicians over water filtration versus sewage treatment plus water filtration as means of protecting water quality and reducing typhoid fever hazard. Economic feasibility and professional expertise were the focus of the debate. A case study of the history of sewage treatment in Pittsburgh is presented and three issues in this case which still persist are summarized. These are the focus on cure rather than prevention, the difference in perceptions of economic necessity and municipal financial limitations, and the different opinions on the social benefit of water quality standards. (Titus-FRC)
W81-00407

UNDERGROUND RESERVOIRS CAN CONTROL STORMWATER OVERFLOWS,
Randolph and Associates, Inc., Peoria, IL.
G. Sherwood, G. Hewitt, and R. Helm.
American City and County, Vol 95, No 3, p 41-43, March, 1980. 3 Fig, 1 Tab.

Descriptors: *Storm runoff, *Waste water treatment, *Storm drains, *Biological oxygen demand, *Water storage, Costs, Illinois, Water pollution, Water quality, Storage tanks, Reservoir storage, Combined sewers, Municipal water, Underground storage, Planning, Design, Settling basins, Remote control.

A system of in-system storage and off-line tanks for storm-water storage to help control discharges into the Illinois River from Peoria has been designed. The plan recommends the use of underground covered storage reservoirs at eight locations with, where possible, remote control regulators. The level of control provided for in this system is an estimated 88% capture of the average annual overflow BOD. Spending twice the proposed investment would have resulted in removing only about 10% more BOD. For small storms, the in-system storage will be sufficient. If runoff continues after the in-system storage has been used up, the basin inlet gate will open to allow flow into the basin. If the storage capacity of Unit 1 is exceeded, Unit 2 will serve as the settling basin for flows up to the state requirement of at least 10 times Dry Weather Flow (DWF). If high runoff rates continue when the basin is already full, the operator may use both units as settling basins. Operating in this mode, at least 20 times DWF can be treated. This stormwater control project has been 'pre-certified' as an innovative/alternative technology by EPA and qualifies for 85% funding. (McKeon-FRC)
W81-00417

WATER FILTER DESIGN: WHAT TO LOOK FOR IN THE EIGHTIES,
K. Grover.
American City and County, Vol 95, No 6, p 39-40, 42-43, June, 1980. 6 Fig.

Descriptors: *Water treatment, *Filtration, *Activated carbon, *Filters, Flocculation, Water purification, Design, Coals, Odor, Taste, Turbidity, Sands, Organic wastes, Carbon filters.

Filter bed design is discussed with emphasis on depth of the filter box, contact time, granular activated carbon (GAC), anthracite beds, and coagulant control. Taste and odor is generally considered to be controlled in 3-4 min in a carbon bed as deep as a conventional coal bed (2-3 ft), and carbon regeneration need only be done every 2 or 3 yr when it is used for this purpose. Estimates, however, for the removal of synthetic organic contaminants range from 10 to 30 min, and most existing filter beds are not deep enough to allow

such long detention times. Studies in Australia have shown that 3 ft of anthracite coal in the filter achieved better turbidity removals than did 2 ft, but layers deeper than 36 inches did not perform significantly better than the 3-ft bed. Philadelphia has found that only the first 12 inches of carbon was active in their GAC filters, suggesting a similar limitation of optimum depth. Pilot tests at the Connecticut Water Company between GAC-sand-gravel, dual- and mixed-media filters have found that at a 6.0 gpm/sq ft filtration rate, the GAC-sand filter performed best. (McKeon-FRC)
W81-00422

DISINFECTION OF WATER TANKS,
A. T. Palin.
Water Services, Vol 84, No 1014, p 515-517, August, 1980. 2 Tab.

Descriptors: *Disinfection, *Chlorination, *Water tanks, *Cleaning, Water purification, Potable water, Chlorine, Bacteria, Microorganisms, Pathogenic bacteria, Costs, Water treatment, Measurement, Water quality control.

During cleaning, water-holding tanks are routinely flushed with heavily chlorinated water (about 10 mg/liter), which is then allowed to stand in the tank for about 2 hr. Residual chlorine in the tank should be 1 mg/liter, and the tank should be covered to prevent subsequent water pollution. This process is effective in eliminating pathogenic microorganisms. Suspended particulates in the rinse water may protect bacteria from the effects of the disinfectant, so it is vital to use clean water. Chlorine is the most widely used disinfectant for drinking water. To evaluate costs of commercial chlorine preparations, knowledge of their available chlorine content is necessary. Chlorine gas is suitable for large-scale use. Solutions contain the chemical form hypochlorite and their available chlorine content is up to 15%. Solid hypochlorites are generally produced as calcium compounds. Chlorinated lime has an available chlorine level of 30-35%. High Test Hypochlorite, a solid calcium hypochlorite in free-flowing granular or tablet form with a long shelf life, has an available chlorine content of 65-70%. Formulas for calculating the amount of disinfectant to be used are presented. To measure the amount of residual chlorine in a water supply, either the DPD or Chlorocol method may be employed. In the DPD method, the Lovibond comparator is used for comparison of the color of water samples, while the chlorocol one-tablet test is a simplification of the DPD method. These disinfection procedures may also be used for water mains and small reservoirs. Bacteriological tests may be performed to confirm disinfection. (Geiger-FRC)
W81-00424

PLANNED PROCESSING BEATS BACK WATER-PLANT SLUDGE DISPOSAL PROBLEMS,
Pirnie (Malcolm), Inc., Paramus, NJ.
G. P. Westerhoff, and G. C. Cline.
Water and Sewage Works, Vol 127, No 10, p 32-34, 36, 58-59, October, 1980. 3 Fig, 1 Tab, 16 Ref.

Descriptors: *Sludge disposal, *Pretreatment(Water), *Coagulation, *Dewatering, Flocculation, Suspended solids, Settling basins, Recycling, Solid wastes, Soil conservation, Reservoirs, Filtration, Water treatment, Costs, Sewage lagoons, Water sources, Water softening, Mechanical equipment.

Water treatment plant waste handling and disposal is becoming more expensive and difficult. Many plants can no longer discharge untreated sludge, but an acceptable method of solids disposal can cost 50% of the plant's operating budget. The objective of waste treatment should be to minimize the solids produced and to maximize the treatability of waste solids. During pretreatment, the possibility of developing new water sources with less turbidity, color, and/or hardness should be considered. Control of suspended solids through nutrient control and soil conservation can reduce solids production in reservoirs. Coagulant dosages can be reduced by optimizing the order of chemical additions, mixing, and flocculation. In softening plants, the quantity of sludges may be minimized by reducing the amount of chemical addition. Sludge collection is usually via sedimentation basin, from which solids are removed manually or mechanically. Filter backwash is treated by the storage and collection of solids in lagoons or liquid-solids separation basins with discharge of the supernatant or, alternatively, by recycling without solids removal (achieving zero discharge). The current trend in sludge treatment is toward dewatering by nonmechanical means because of the low cost. Where mechanical dewatering is cost effective, the trend is to use pressure filters for coagulant sludges and vacuum filters for lime-softening sludges. The use of regional sludge treatment may increase in the future. The development of new technologies in this area is necessary. (Gish-FRC)
W81-00438

REMOVAL OF ORGANICS IN WATER USING HYDROGEN PEROXIDE IN PRESENCE OF ULTRAVIOLET LIGHT,
Health and Welfare Canada, Ottawa (Ontario). Monitoring and Criteria Div.
M. Malaiyandi, M. H. Sadar, P. Lee, and R. O'Grady.
Water Research, Vol 14, No 8, p 1131-1135, August, 1980. 4 Fig, 2 Tab, 15 Ref.

Descriptors: *Water purification, *Ultraviolet radiation, *Oxidation, Organic wastes, Ozone, Gas chromatography, Water treatment, Analytical techniques, Laboratory tests, Potable water, Research and development.

Optimum conditions for the removal of dissolved organics from water intended for drinking or for high-purity research purposes were investigated using hydrogen peroxide and ultraviolet (UV) light as the purification techniques. When hydrogen peroxide is used under UV light, cleavage of the 0-0 bond yields hydroxyl (OH) radicals which are extremely reactive with most organic molecules with H-atom donor properties. In the present study, reactive OH radicals were generated in tap and distilled water samples using UV light of wavelength above the 200 nm system and a 50% hydrogen peroxide solution. The photochemically initiated OH radical oxidation decreased the total organic carbon (TOC) content of distilled water samples by about 88% and the TOC content of tap water by about 98%. Gas chromatographic analysis of hexane extracts of distilled and tap water samples before and after treatment for organic removal showed that approximately 12% of the electron-capturing residual organics were still present after hydrogen peroxide/UV light treatment. These findings show that water may be rendered nearly free of organic impurities by this relatively simple but efficient method. (Geiger-FRC)
W81-00498

5G. Water Quality Control

FURTHER INVESTIGATIONS OF ALUMINA-LIME-SODA WATER RECOVERY APPLICATIONS,
Midwest Research Inst., Kansas City, MO.
J. W. Nebgen, and G. D. Hinshaw.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127326, Price codes: A04 in paper copy, A01 in microfiche. Final Report for Office of Water Research and Technology. October, 1980. 59 p, 5 Fig, 27 Tab, 6 Ref. OWRT-C-90005-S(No 9504)(1), 14-34-0001-9504.

Descriptors: *Water purification, *Trace elements, *Water chemistry, *Laboratory tests, *Water treatment, *Alkalinity, Analytical techniques, Research and development, Water analysis, Aluminum, Chemical reactions, Lime, Arsenic compounds, Chromium, Sulfates, Sulfur compounds, Inorganic compounds, Hydrogen ion concentration.

Findings of a laboratory study undertaken to define the range of applications of the alumina-lime-soda process have been reported. This process was effective for the removal of calcium sulfate at pH 12, and for the removal of dissolved silica in the pH range of 8.5-9 in earlier studies reported by Midwest, while emphasis of the present study was directed towards removal of trace constituents in water. The study findings revealed that oxygenated anions of toxic elements such as arsenic, selenium, and chromium (VI) behaved similarly to sulfate, and could be removed by alumina-lime-soda at pH 12. It was observed that borate ion could also be removed at pH 12, but only in the presence of sulfate. Furthermore, phosphate and color due to dissolved organic matter can be removed in the 8.5-9 pH range, using the same conditions as for removal of dissolved silica by alumina-lime soda. Heavy metals such as copper and zinc were also removed under these conditions. Mechanisms for removal of solutes by aluminum species generated during alumina-lime-soda treatment have been postulated. (Zielinski-IPA)
W81-00316

CONTROL OF POLLUTION IN WATERS CONTAINING HEAVY METALS,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
D. F. Kincannon, M. H. Bates, and R. N. DeVries.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124133, Price codes: A05 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute, Oklahoma State University, Completion Report, September, 1980. 87 p, 31 Fig, 5 Tab, 64 Ref. OWRT-A-087-OKLA(1), 14-34-0001-8038.

Descriptors: *Heavy metals, *Water pollution sources, Lead, Chromium, *Pollutants, *Water pollution control, Water pollution, *Waste water treatment, Chemical wastes, Metals, *Oklahoma, Chemical reactions, Chemical precipitation, Pollutant identification, Analytical techniques, Activated sludge, Biodegradation, Soils, Soil chemistry, Sediments, Soil types.

An integrated set of experiments were carried out on the fate of chromium and copper in biological waste water treatment processes, aqueous environments, and soil systems. A rotating biological contactor and activated sludge were used as the waste water treatment processes; Stillwater, Oklahoma area lake and river water and sediments, as the aqueous environments; and sandy and red silty clay soils, as the soil systems. While it was determined that chromium was removed by the lake and river sediments but not generally removed by biological treatment processes or by algae, it was found that copper was removed by all systems. Removal efficiencies of the metals were highly dependent upon operating and environmental conditions. Sediments and soils had strong affinities for copper, and uptake could be correlated with soil type. Soluble copper reduction in aquatic systems occurred by precipitation. In general, the results indicated that copper is probably of less environmental concern than chromium since it is so readily removed by all systems studied. Heavy metal contamination of the environment can be minimized by proper management practices. Reduction of copper and chromium pollution in aqueous environments were deemed attainable by correct treatment choices, and an understanding of their fate in aqueous systems. (Zielinski-IPA)
W81-00323

SCALE REDUCTION IN PHYSICAL HYDRAULIC MODELS OF THERMAL DISCHARGES,
Clemson Univ., SC. Water Resources Research Inst.
B. L. Sill.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-126526, Price codes: A07 in paper copy, A01 in microfiche. Technical Report No 90, September 1980. 146 p, 31 Fig, 18 Tab, 19 Ref, 6 Append. OWRT-B-119-SC(1).

Descriptors: *Electric powerplants, *Thermal water, *Heat transfer, *Hydraulic models, *Water cooling, Physical hydraulic modeling, Thermal discharges, Scale reducting, Surface heat transfer, Surface heat exchange coefficients, North Carolina, Belews Creek Stream Station(NC), *Lake Belews(NC).

An experimental procedure is developed to study the behavior of the water-air heat transfer in indoor physical hydraulic models of thermal discharges. Using this procedure, the value of the indoor heat exchange coefficient is determined and used to calculate the allowable distortion of scale in a far field thermal discharge model. In preparation for an actual model study, scaling requirements were reviewed for the following far field processes: (a) convective spread, (b) turbulent dispersion, (c) head loss, and (d) surface cooling. The necessary distortion of scale differs for each of the different mechanisms, forcing researchers to ignore those that are less important. The theory and procedures developed were tested by modeling Lake Belews, a thermally loaded lake near Winston Salem, N.C. Because of limits to the allowable distortion of the vertical to horizontal scale ratio in the model, only a portion of the prototype could be modeled, emphasizing the need for a way to increase the allowable distortion by enhancing the water-air heat transfer in the indoor model. Results indicate that the proposed enhancement technique allows an increase in prototype area modeled and retains satisfactory accuracy of isotherm position and magnitude.
W81-00327

A ONE-DIMENSIONAL, STEADY-STATE, DISSOLVED-OXYGEN MODEL AND WASTE-LOAD ASSIMILATION STUDY FOR THE WABASH RIVER, HUNTINGTON COUNTY, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Di.
For primary bibliographic entry see Field 5B.
W81-00354

METHOD FOR BRINGING NUTRIENT-RICH WATER FROM THE APHOTIC ZONE OF THE OCEAN TO THE PHOTIC ZONE,
For primary bibliographic entry see Field 3A.
W81-00367

DEBRIS SEPARATION AND DISPOSAL SYSTEM,
A. J. Aman.
U.S. Patent No 4,189,386, 12 p, 16 Fig, 2 Ref; Official Gazette of the United States Patent Office, Vol 991, No 3, p 991, February 19, 1980.

Descriptors: *Patents, *Water pollution, *Water pollution treatment, Water quality control, Industrial water, Powerplants, *Intakes, Filters, Debris.

A system for the removal and disposal of debris from the water intake of power plants or the like is disclosed. The system includes a strainer basket having pivoted, separable sections movable from an abutting position to an open position. The sections are biased to the abutting position by gravitational forces acting upon the basket sections and their contents. The system further includes structure for opening portions of the basket to empty the contents into a suitable disposal recepticle. The opening device is positioned on the debris-receiving receptable and has cam surfaces for separating the basket sections. The object of this invention is to provide a bottom-emptying straining device which does not require latches or other mechanical fasteners to secure it in the closed position during straining and which will operate during freezing weather without the need for artificial heating. (Sinha-OEIS)
W81-00371

NOVEL COMPOSITIONS OF MATTER FOR USE IN THE TREATMENT OF AQUEOUS SYSTEMS,
Ciba-Geigy Corp., Ardsley, NY. (Assignee).
P. Miles, N. Richardson, and M. A. Finan.
U.S. Patent No 4,189,383, 6 p, 2 Tab, 12 Ref; Official Gazette of the United States Patent Office, Vol 991, No 3, p 990, February 19, 1980.

Descriptors: *Patents, *Water treatment, *Scaling, Water quality control, Industrial water, Chemical reactions, Hydraulic systems, Telomers.

The invention relates to telomeric compounds which show good control of calcium carbonate, calcium sulphate and magnesium hydroxide scales and more importantly modify the crystal structure of the scale so that it is non-uniform and easily removable. A method is provided for inhibiting scale formation from aqueous solutions over a wide range by adding a minor proportion of a product comprising a telomer of a formula which is disclosed. Examples illustrate how the formula may be used. (Sinha-OEIS)
W81-00373

WATER SOFTENING SYSTEM,
J. W. Braswell.
U.S. Patent No 4,181,605, 10 p, 10 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 990, No 1, p 249, January 1, 1980.

Descriptors: *Patents, *Water treatment, *Water softening, *Demineralization, Iron exchange resins, Water quality control, Flow control, Instrumentation, Equipment, Backwash, Regeneration.

The water softening system employs a treatment tank containing a mineral bed of ion-exchange resin granules, a brine tank, and a valve for periodically cycling water through the mineral bed for removing hardness and other undesirable factors. A diluted brine solution is passed through the bed in a opposite direction to its normal service flow to recondition and flush the bed. The control for the system includes electrically operated solenoid diaphragm valves, and a plunger valve responsive to water pressures, for controlling and regulating the flow of water and brine through the mineral bed. A venturi aspirator is incorporated in the plunger valve, so that a saturated brine solution is drawn and with controlled dilution is caused to flow in a direction opposite to service flow through the mineral bed. (Sinha-OEIS)
W81-00377

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

MAXIMIZING THE UTILITIES OF SOCIAL CRITERIA FOR URBAN WATER MANAGEMENT AND PLANNING,
For primary bibliographic entry see Field 6B.
W81-00264

WATER RESOURCES OF THE RIO GRANDE AN INTERDISCIPLINARY APPROACH,
New Mexico State Univ., Las Cruces.
R. R. Lansford.
In: A Quarter Century of Water Research. Proceedings of the Twenty-Fifth Annual New Mexico Water Conference. Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 59-63. New Mexico Resources Research Institute, New Mexico State University, Box 3167 Las Cruces, NM 88003.

Descriptors: *New Mexico, *Rio Grande, *Water management(Applied), *Water resources, *Project purposes, Project planning, Resources, Management, Coordination, Creativity, Project feasibility, Universities.

The strengths and results of interdisciplinary research were identified, regarding their application to water resources conservation, allocation and management in the Rio Grande area of New Mexico. Three projects were used as examples to illustrate how as many as seven different departments of three universities and scientific institutions developed the projects. The projects started from brainstorming sessions, progressed to the formative stages, were funded and produced successful results. The successful project format included using an advisory committee of diverse state and federal agency representatives, that met with the research staff on technical and policy questions. A contributing factor to the success of the projects was the dialogue brought about by research meetings that allowed members to receive technical language differences, and to develop meaningful task direction. The project results were methodology and criteria that can be applied to water management projects in similar semi-arid areas in the United States and the world. (Meade-Omniplan)
W81-00394

FEDERAL WATER LEGISLATION,
Senate Committee on Environment and Public Works (U. S. Senate).
H. Brayman.
In: A Quarter Century of Water Research. Proceedings of the Twenty-Fifth Annual New Mexico Water Conference. Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 181-191. New Mexico Resources Research Institute, New Mexico State University, Box 3167 Las Cruces, NM 88003.

Descriptors: *Legislation, *Water resources development, *State governments, *Planning, *Water policy, Expenses, Economic impact, Construction costs, Jurisdiction, Administrative agencies, Equitable apportionment, Projections.

Federal spending for water resources projects is down about 50% from the mid-sixties. There are no priorities in the program; project selection is basically on an 'ad hoc' basis. Public support for water development programs is very low. Senator Peter Domenici development 3 criteria to improve the system: (1) try to find a way to put more money into the program; (2) create a system to select priorities; (3) broaden the constituency. Domenici introduced Bill S1241 which was later amended to 1660. The object of S1241 was to remove Congress from the individual selection and appropriation of projects; each state would perform that function. Four billion dollars a year for construction was allocated, to be distributed on a formula based half on the population of a state and half on land area. Amendment 1660, adopted by the Senate subcommittee on water, is a 5 year demonstration of the block allocation described in S1241, but with an allocation of $1 billion a year. This system would work in tandem with the existing line-item approach and provide a basis for future comparisons of the systems. No major project bills are expected in the next year. Some federal compromises might include: (1) more projects; (2) variation(s) on the Domenici-Moynihan block allocation system; (3) changes in the cost-sharing process in developing water projects. (Atkins-Omniplan)
W81-00399

6B. Evaluation Process

STORMWATER MANAGEMENT IN THE UNITED STATES A STUDY OF INSTITUTIONAL PROBLEMS, SOLUTIONS AND IMPACTS,
Stormwater Consultants, Bolingbrook, IL.
For primary bibliographic entry see Field 4A.
W81-00263

MAXIMIZING THE UTILITIES OF SOCIAL CRITERIA FOR URBAN WATER MANAGEMENT AND PLANNING,
D. W. Hill.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121055, Price codes: A11 in paper copy, A01 in microfiche. Completion Report to Office of Water Research and Technology, September 1980, 89 p, 12 Fig, 4 Tab. OWRT-C-4222(No 9033)(1), 14-31-0001-9033.

Descriptors: *Attitudes, *Social participation, *Regression analysis(R-sort), *Data processing, *Data retrieval, Social aspects, Statistical methods, Probability, Water planning, Watermanagement, Sampling, Social aspects, *Space-distance model, Factor score, Control point, Q-sort, Communications, Goal structure, Factor analysis.

A research effort was mounted to develop and test social criteria for effective use in the water management and planning community. The research design employed a space-distance model which

involved factor analytical software for comparing empirical data generated from five community household samples. The machine output was then used to assess data relationships and to identify those social variables (i. e., those control points) which channel and direct other variables. Research results indicated: (a) that factor scores from Q-Sort factor analysis programming offer the water management and planning community a ready means for estimating, (i) interactive effects among social variables and (ii) which variables are the most probable controllers; (b) that presently, problems stemming from the softness of social data will be more effectively addressed by increasing quality control on data retrieval before increasing statistical refinement; (c) that action and communications variables as well as overall life goal structures appear to be strong candidates for control points; and (d) that effective action and communications patterns need to be distinguished sharply from affective action and communications patterns.
W81-00264

TENNESSEE-TOMBIGBEE CORRIDOR AREA: GROWTH FORECASTING AND MANAGEMENT,
Army Engineer District, Mobile, AL.
A. V. Galdis.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25 September 1979. p 15-17 (1979) 3 Fig.

Descriptors: *Tennessee-Tombigbee Waterway, *Economic impact, *Regional economics, *Social impact, Employment, Social change, Planning, Management, Inland waterways, Kentucky, Tennessee, Alabama, Mississippi.

The area to be economically affected by the construction of the Tennessee-Tombigbee Waterway encompasses 48 counties in Alabama, Kentucky, Mississippi, and Tennessee and covers 29,300 square miles from the Ohio River to the Gulf of Mexico. Three Congressional resolutions were issued authorizing the Corridor Study to aid local communities, counties, and agencies with their planning needs. The economic studies are organized into two phases with several tasks in each phase. Phase One, the Pilot Studies, uses existing county level impact assessment models for four counties to analyze data needs for the investigations of the entire area. The two models used in this phase are the Economic Impact Forecasting System (EIFS) and the Social and Economic Assessment Model (SEAM). After the selection of analysis tools in Phase One, Phase Two, the studies for all 48 counties, will begin. Meetings will be held at planning agencies throughout the area to explain the analyses to residents and officials. Due to the high number of equally well-endowed sites along the waterway for industry, it is likely that site selection will be based on the will and ability of an area to solve problems associated with that site. (See also W81-00290) (Seigler-IPA)
W81-00294

INCOME DISTRIBUTION AND WATER RESOURCE PROJECTS: TESTING THE CLASSICAL THEORY OF ECONOMIC DEVELOPMENT,
Mississippi State Univ., Mississippi State. Dept. of Economics.
B. J. Eatherly.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25 September 1979. p 19-21 (1979) 4 Ref.

Descriptors: *Regional economics, *Social impact, *Economic impact, Social change, Income distribution, Employment, Income analysis, Wages, Social values, Labor, Labor mobility, Employment opportunities, Capital, Land tenure.

Large-scale water resource projects provide something of a controlled social experiment and are an excellent opportunity for social scientists to learn more about the benefits and costs of industrial growth. Water resource projects produce a sudden flow of construction activity and ultimately change the sales and purchase opportunities for the residents of the area. Economic growth and its effect on social classes can be approached from the classical viewpoint of a closed society. Ownership arrangements in a society are important when the basis of economic growth is the production of a resource. Classical economics defines three groups of resources, land, labor, and capital. Classical economics are used to discuss these groups and their attitudes toward events such as a large-scale water project. It appears that contrary to the economic assessment, capitalists and laborers tend to favor such projects while landowners do not. A consideration of short-vs-long-run benefits or external effects can help to explain these attitudes. A brief discussion of labor migration is included. (See also W81-00290) (Seigler-IPA)
W81-00295

A FIELD TEST OF ENVIRONMENTAL IMPACT ASSESSMENT IN THE TENSAS BASIN,
Mississippi State Univ., Mississippi State. Dept. of Anthropology.
J. H. Peterson, C. A. Clinton, and E. Chambers.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25 September 1979. p 27-32 (1979) 1 Fig, 5 Tab, 2 Ref.

Descriptors: *Louisiana, *Environmental effects, *Economic impact, *Social impact, Regional development, Planning, Regional analysis, Flood control, Channel improvement, Tensas River, Anthropology, Ecology, Engineering, Alternative planning.

A field test of Water Resources Assessment Methodology (WRAM) procedures was conducted at the Tensas River Basin project in northeastern Louisiana. WRAM is a procedure for assessing and evaluating impacts in the areas of economic development, environmental quality, regional development, and social well-being. The Tensas River Basin has a flooding problem and the project calls for extensive channel improvements along 99 miles of the river. Five alternative plans and a 'no action' alternative are being considered. WRAM requires the formation of an interdisciplinary team representing the areas of ecology, economics, engineering, and sociology/anthropology. A preliminary list of mandatory and critical variables is assembled and the variables are weighted. Data are then collected and analyzed for impact projection and sealing. Finally a summary table is constructed for each account listing each variable and its weight and impact for each alternative. It is concluded that the Tensas study was a useful test of the WRAM procedures. The use of the interdisciplinary team proved to be quite successful in that it allowed division of labor, a system of checks and balances, and duplication of effort was minimized. (See also W81-00290) (Seigler-IPA)
W81-00297

ANALYSIS OF RISK IN USING LAKE WATER SUPPLIES FOR SALMON HATCHERIES IN ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
P. M. Fox, and R. F. Carlson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124125, Price codes: A02 in paper copy, A01 in microfiche. Completion Report 77-22-C, August, 1980. 18 p, 6 Fig, 7 Ref, 1 Append. OWRT-A-063-ALAS(1), 14-34-0001-8002.

Descriptors: Risks, Uncertainty, Analytical techniques, *Mathematical models, *Water supply, *Lake fisheries, *Alaska, *Salmon, Operations research, Computer models, Mode studies, Statistics, Statistical methods, Analysis, Lakes, Facilities, Estimating, Forecasting, Planning, Water resources.

The primary study objective of analyzing the risk of using northern lakes as a water supply for an extensive salmon hatching program was carried out by means of five sub-objectives. These ranged from the analysis of water supply needs of proposed salmon rehabilitation facilities with acceptable uncertainties in water quality parameters of established criteria; to use of the authors' northern lake model; to use of Baysian decision analysis techniques for risk and failure estimates. Planning strategies were considered. Lack of ample data imposed some limitations. It was concluded that it is possible to estimate basin streamflow with very little data. The reported method provided a viable solution. The developed methods can be used with spot discharge measurements and general information on the hydrologic pattern. This was the most common data situation. The results have potential benefit to those in coastal Alaska needing streamflow and lake water estimates, and provide an example of methods for incorporating risk and uncertainty into deterministic models. (Zielinski-IPA)
W81-00313

AN ECONOMIC ANALYSIS OF THE EFFECTS OF REGULATORY DELAY ON NUCLEAR POWER PLANT CONSTRUCTION,
Clemson Univ., SC. Water Resources Research Inst.
M. T. Maloney, and M. D. Walsh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124422, Price codes: A06 in paper copy, A01 in microfiche. Technical Report No 89, August 1980. 78 p, 3 Fig, 33 Ref, Append. OWRT-A-042-SC(1).

Descriptors: *Construction costs, *Nuclear powerplants, *Cost analysis, *Construction delay costs, Model studies, Economics, Governments, Regulation, Cost-benefit analysis.

In order to evaluate the impact that any government regulation has on society, an accurate measure of the costs imposed by the regulation is essential. Current government estimates of the cost of pollution control legislation have failed to include the costs of project delays that firms may experience when complying with such standards. Clearly, if these delays are the direct result of such legislation their costs should be included for a proper evaluation. The purpose of this report is to define and measure the true impact that construction deals have on the total project costs of a specific industry. The Nuclear Power Industry has been chosen to illustrate the problem. First, the industry is examined in terms of its economic and physical environment. A model is then developed to deal with the costs involved in the construction of a typical nuclear plant. The model is tested by regressing time and cost data of 31 completed plants to determine the impact that unanticipated delays have had on total project costs. These results indicate that such delays would increase the total project costs of a typical 1,000 mw plant by .8 percent per month in the initial stage of the project and 1.1 percent per month after actual construction begins.
W81-00328

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ESTIMATING IRRIGATION WATER QUANTITY AND QUALITY,
California Univ., Davis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6D.
W81-00271

WATER CONSERVATION ALTERNATIVES FOR THE NORTH,
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
For primary bibliographic entry see Field 3D.
W81-00384

WE INSTALL OUR OWN WATER MAINS,
Valparaiso Dept. of Waterworks, IN.
For primary bibliographic entry see Field 8A.
W81-00433

6D. Water Demand

ESTIMATING IRRIGATION WATER QUANTITY AND QUALITY,

California Univ., Davis. Dept. of Civil Engineering.
O. J. Helweg, and D. Alvarez.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 106, No IR3, Proceedings Paper 15712, p 175-188, September 1980. 13 Fig, 4 Tab, 6 Ref, 2 Append. OWRT A-060-CAL(3).

Descriptors: *Irrigation water, *Water demand, *Water supply, *Pricing, *California, Costs, Economics, Water management(Applied), Irrigation, Demand, Water quality, Salinity, Water values, Crops, Citrus fruits, Semiarid climates, Agriculture, Available water.

The value of water quantity and quality is shown by its demand curve (surface); but because the market for water is imperfect, the demand surface must be derived by other means. This paper shows a theoretical process for determining the derived demand surface for both water quantity and quality, using data for citrus crops in California. The results show that for the relevant price range, the demand for water quantity is relatively inelastic, indicating that pricing is not an attractive mechanism for controlling water distribution; however, the demand for water quality is relatively elastic which makes pricing a possible means for managing water quality. The results also support the claim that the value of water is considerably more than most irrigators pay for it. (Sims-ISWS)
W81-00271

6E. Water Law and Institutions

INDUSTRIAL COST RECOVERY: WHY IT SHOULD BE KILLED,
Philadelphia Water Dept., PA.
C. Guarino.
American City and County, Vol 95, No 6, p 57-59, June, 1980. 1 Fig.

Descriptors: *Industrial wastes, *Industrial water, *Municipal wastes, *Industrial Cost Recovery program, *Clean Water Act, Waste water treatment, Water conservation, Legislation, Industrial plants, Municipal water, Treatment facilities, Economic efficiency, Use rates, Water pollution.

The author recommends that the Industrial Cost Recovery (ICR) program, developed to avoid government subsidy of industrial water cleanup under the Clean Water Act of 1972, be discontinued because it has failed to meet its objectives and has become a hindrance to the implementation of the Clean Water Act. ICR was developed to ensure that no unfair competitive advantage would result from a company being connected to a municipal water system rather than treating its own wastes, but evidence indicates that this is a rare occurrence and that the imposition of ICR charges has in some cases resulted in companies withdrawing from municipal systems. ICR was also established to prevent the funding of municipal treatment systems with too much capacity due to the overestimation of industrial contributions, but this can be achieved through other channels, such as EPA grant regulations. Thirdly, ICR was designed to encourage industry to conserve water and to produce less waste water, but in industrial users do not cite ICR payments as a reason for conserving water. In addition, ICR is considered an inefficient way to collect revenue for local government, the management of local ICR systems is expensive, pretreatment programs are reducing the qualitative differences between industrial and domestic discharges so that there is no reason for industrial users to pay an extra charge, user charge systems are more efficient than ICR, municipalities with approved ICR systems have not elected to use them, and ICR does little for pollution control. (Gish-FRC)
W81-00259

TIME FOR A NEW CLEAN WATER PROGRAM,
R. A. Pavia.
American City and County, Vol 95, No 6, 53-54, June, 1980. 1 Fig.

Descriptors: *Clean Water Act, *Government finance, *Local governments, *Federal government, *Water pollution control, Legislation, Municipal water, Governmental interrelations, State governments, Waste water treatment, Costs, Use rates, Environmental Protection Agency, Administrative agencies.

The author considers that one way of limiting federal spending would be to return the Clean Water program to the local agencies responsible for the cleanup, as they can borrow money inexpensively through tax-free municipal bonds. Several program modifications are suggested to alleviate problems such as lack of funds and failure of new treatment plants to meet program specifications. These include authorizing funds for a 5-yr continuation of the waste water treatment grant program with a change in matching ratio to 67% federal-33% local, spelling out long-range objectives of the program, which will have waste-water agencies functioning as utilities responsible for operating and maintenance costs as well as financing new or replacement facilities, legislating mandatory reviews of existing water quality standards, and encouraging consolidation or regionalization of waste-water systems. The author also recommends establishment of a treatment technique advisory committee, accelerating dissemination of data, establishing teams of experts to recommend reforms to facilities not meeting performance standards, setting higher priorities for treatment applications or making projects in unsewered areas ineligible, considering making ineligible tertiary treatment projects and sewer-related projects, and re-evaluation of the role of each level of government. The author stresses that the separation between the three levels of government should be restored; the sewerage construction grants program should be assigned to the states, and local government should be granted more freedom. (Gish-FRC)
W81-00260

GROUND WATER MINING AND WESTERN WATER RIGHTS LAW: THE NEBRASKA EXPERIENCE,
Nebraska Univ., Lincoln.
J. D. Aiken, and R. J. Supalla.
South Dakota Law Review, Vol 24, No 3, p 607-648, Summer 1979. OWRT B-045-NEB(No 8098)(1).

Descriptors: *Nebraska, *Groundwater mining, *Groundwater availability, Water rights, Groundwater, Legislation, Irrigation, Water allocation(Policy), Water users, Administrative agencies, Water conservation, *Groundwater management(Applied).

Depletion of ground water supplies due to irrigation is one of the major water policy questions facing the western states. Traditional responses have included ignoring the problem, or utilizing a supplemental water supply. Regulating ground water withdrawals has not been implemented, because it is perceived as too politically controversial. The 1975 Nebraska Ground Water Management Act (Act) is among the first administrative attempts to significantly reduce ground water withdrawals. The Act gives each local Natural Resource District (NRD) the option of regulating ground water use through the establishment of ground water control areas. Ground water controls authorized by the Act include: (1) well spacing restrictions; (2) rotation of pumping restrictions; (3) ground water allocation by establishing what quantities may be withdrawn; and (4) well drilling moratoria. In addition, an NRD may adopt other reasonable ground water controls. The Act also requires NRD's to establish and enforce regulations to control runoff from ground water irrigation. The blend of local and state responsibilities implicit in the Act has led to cooperation among state and local natural resource agencies and to an increased awareness of various aspects of ground water management. (Wilson-Florida)
W81-00269

INDIANA FIVE-YEAR WATER RESOURCES RESEARCH AND DEVELOPMENT PLAN, FISCAL YEARS 1982-1986,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121253, Price codes: A07 in paper copy, A01 in microfiche. Report submitted to Office of Water Research and Technology, 1980. 125 p, 2 Tab, 7 Append.

Descriptors: *Research priorities, *Indiana, *Water resources, *Water resources development, *Planning, *Water resources institute organizations, Water sources, State jurisdiction, State governments, Precipitation(Atmospheric), Hydrology, Water supply, Research and development, Groundwater, Water pollution, Water quality, Pollutants, Water reuse, Mining, Computer models.

The geographical location of Indiana is such that it receives an ample supply of water on an average annual basis through precipitation. However, substantial and generally unpredictable variations in the precipitation as the water supply source have direct and essentially immediate impacts whose seriousness depends on a number of factors. Indiana water resources problems have been categorized into six areas: (1) hydrologic and hydraulic processes; (2) planning and institutions; (3) water quality; (4) atmospheric and precipitation processes; (5) hydrologic-ecologic relationships; and (6) water supply, development and management. Fifty-three research priorities were determined for these six areas. The highest-ranked priority for each of these areas was, respectively: (1) study hydraulic characteristics of crest overburden from mined reclaimed areas; (2) improve detection, identification, decomposition, residual and trackin pollutant movements in ground/surface waters; (3) study methods of integrating flood plain management into a regional comprehensive land use planning process; (4) study ecological resonse to the seven day, one in ten year low flow design criteria; (5) develop mixed hydrologic-hydraulic computer models to forecast droughts, severe storms, and routing water through conveyances, including improved methodologies for reservoir management; and (6) evaluate direct/indirect impacts and benefits of urban water reuse applications, including industrial, agricultural, and municipal reuse. (Zielinski-IPA)
W81-00279

NORTH CAROLINA'S FIVE-YEAR WATER RESEARCH PROGRAM FOR 1982-1987,
North Carolina Water Resources Reserch Inst., Raleigh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121295, Price codes: A05 in paper copy, A01 in microfiche. October, 1980. 77 p, 6 Fig, 7 Tab, 33 Ref.

Descriptors: *North Carolina, *Research priorities, *Water quality, *Water quantity, Eutrophication, Fish kills, Estuaries, Drainage, Hydrology, Industrial wastes, Water pollution sources, Budgeting, Programs, Shellfish, *Five-year plans.

The rapid rate of industrialization, urbanization, and power growth in North Carolina has produced three major study and research areas of immediate concern: water resources planning and management, water quality management, and water quantity management. North Carolina's Water Resources Research Institute has selected these areas for the focus of its future concern. In water resources planning and management, estuaries and their develement are a high priority due to the State's 2.2 million acres of estuaries. Fish kills, algal blooms, and shellfish water closings will receive atention in water quality research. Water quantity management will be highly concerned with hydrology and drainage. In all three research areas technology transfer will also be a priority. The Institute will sponsor research based on relevancy to priority problems and scientific merit. Additional high priority areas include instream flow needs, energy/water relationships, stormwater management, pollutant identification, industrial wastes, groundwater pollution, and water quality standards. Recreation and irrigation are considered low priority research areas. Tables of proposed distribution of funds by budget activity and priority level are given for each year in the five-year program. (Seigler-IPA)

W81-00280

A 1982-87 RESEARCH PROGRAM FOR THE UNIVERSITY OF ILLINOIS WATER RESOURCES CENTER,
Illinois Univ. at Urbana-Champaign. Water Resources Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121287, Price codes: A05 in paper copy, A01 in microfiche. Report submitted to Office of Water Research and Technology, October 13, 1980. 81 p, 2 Fig, 10 Tab.

Descriptors: *Illinois, *Research priorities, *Water allocation(Policy), Water quality, Water quantity, Budgeting, Eutrophication, Water pollution sources, Erosion, Flooding, Water shortages, Ecosystems, Floodplains, Silting, Irrigation water, *Five year plans.

Nine critical water problems are identified for Illinois: depletion of aquifers, lake siltation, sediment pollution, potential groundwater contamination, long-term health effects of water contamination, inadequate water treatment technology, the possible destruction of ecosystems, future irrigation demands, and the statewide diffusion of water authorities. Other problems are considered urgent such as: rural flooding, the lack of authority over floodplain management, advanced water treatment plant costs, regional water competition, and inefficient sewer designs. Problems classified as important are: urban flooding, water shortages, new water sources augmentation, water distribution system conservation, agricultural chemical pollution, hazardous wastes disposal, and channel conveyance legal problems. Precipitation in Illinois is variable ranging from 32 to 46 inches annually. Surface water quality is generally good with sedimentation from soil erosion a primary nonpoint source pollutant. Groundwater quality is also generally good. The most severe water shortages in the near future will be in the area around Chicago. To solve these problems, a program of research priorities and technology transfer is described. Projected annual funding requirements and allocations by priority are given. (Seigler-IPA)
W81-00281

A FIVE-YEAR PLAN FOR WATER RESOURCES RESEARCH IN ARIZONA,
Arizona Water Resources Research Center, Tucson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121279, Price codes: A04 in paper copy, A01 in microfiche. October 1980. 68 p, 5 Fig, 13 Tab, 12 Ref, 2 Append.

Descriptors: *Arizona, *Research priorities, *Groundwater depletion, Groundwater mining, Groundwater recharge, Water conservation, Water rights, Planning, Budgeting, Water reuse, Water pollution, Efficiencies, Information exchange, Agriculture, *Five-year plans.

Arizona's underlying water resources problem is the perennial overdraft of groundwater. The legal basis of water use is largely the key to this problem, but priority research is being designed to help. Future research will be aimed at: (1) greater efficiency of agricultural, industrial, and urban water; (2) broader implementation of water conservation measures and water reuse; and (3) ways of dealing both physically and legally with the continuing groundwater recharge/depletion imbalance. Water quality problems emphasis will be placed on the protection of groundwater and surface water, and on effective methods for monitoring and maintaining water quality standards. In all research areas, information dissemination will be a priority in order to realize the full potential of the benefits from the research. Three kinds of water depletion forecasts are given to estimate Arizona's water needs for 1970-2020. Arizona has 17 problem areas classified as 'very high priority'. An extensive table is given listing the priority problems and the research tasks needed to help solve them. Also given is a table of funding allocations for the priority areas at a $125,000 annual funding level and at a $250,000 annual funding level. (Seigler-IPA)

W81-00282

VERMONT WATER RESOURCES RESEARCH CENTER FIVE-YEAR PLAN FOR WATER RESOURCES RESEARCH AND DEVELOPMENT,
Vermont Water Resources Research Center, Burlington.
M. Long, and E. A. Cassell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-123721, Price codes: A04 in paper copy, A01 in microfiche. October 1980. 53 p, 4 Fig, 9 Tab, 21 Ref.

Descriptors: *Vermont, *Research priorities, *Water resources, Planning, Acid precipitation, Water allocation(Policy), Waste water treatment, Hazards, Toxicity, Potable water, Public health, Electric power production, Surface runoff, *Five-year plan.

Vermont has identified eight priority research areas: (1) acid precipitation, (2) allocation of water resources, (3) data base for water resource management, (4) groundwater management, (5) lakes and wetlands management, (6) land runoff, (7) management of toxic and hazardous materials, and (8) waste water management and drinking water supply. Vermont has an average annual precipitation of 42 inches and is generally decentralized both culturally and hydrologically. This decentralization presents special management problems due to the economic limitations on small communities in the provision of facilities for water supply and waste water treatment. Some problems such as acid precipitation and toxic and hazardous materials management originate outside of the State and need regional research efforts. Energy production significantly impacts Vermont's water use with 70% of total use since 1975 being attributed to cooling at electric production facilities. Major factors in the State's five-year plan are vigorous technology transfer and information dissemination efforts. A generic listing of research projects and technology transfer activities considered necessary for Vermont is presented along with a table showing the interrelationships of the various program elements and the research projects. (Seigler-IPA)
W81-00283

FIVE-YEAR WATER RESOURCES RESEARCH PROGRAM,
Kentucky Water Resources Research Inst., Lexington.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121261, Price codes: A04 in paper copy, A01 in microfiche. October 1980. 66 p, 5 Tab, 22 Ref.

Descriptors: *Kentucky, *Research priorities, *Water quality, *Water quantity, Budgeting, Flood forecasting, Eutrophication, Acid mine water, Coal mines, Industrial water, Allotments, Water resources, Grants, Agriculture, Groundwater resources, *Five-year plans.

Kentucky's water resource problems are grouped into two large areas, water quntity and water quality. The State's water quality is in general good with moat streams being the calcium bicarbonate type. Kentucky has a statewide average rainfall of 45 inches per year and groundwater is plentiful in many parts of the State. Farming uses about 71 billion gallons annually; municipal, 71 billion gallons annually; and industry 220 billion gallons annually. Despite the current plentiful supply of water in Kentucky, problems do exist such as pollution, flooding, water hardness, erosion, acid mine drainage, and iron in the water. Five large priority areas with specific research needs have been selected to guide in problem solving. Those areas are: (1) coal development, which will require large amounts of water for extraction and processing; (2) hydrological extremes, flooding and droughts are regional occurrences and better forecasting and management are needed; (3) agriculture and forestry, which consume large quantities of water, and are also major sources of nonpoint pollution; (4) water quality, research is needed on siltation, eutrophication, acid rainfall, pollutant transport, and groundwater pollution; and (5) the development of water allocating strategies and industrial plant siting guidelines. A five year budgeting plan for these research priorities is included. (Seigler-IPA)
W81-00285

FIVE-YEAR WATER RESOURCES RESEARCH AND DEVELOPMENT GOALS AND OBJECTIVES,
Missouri Water Resources Research Center, Columbia.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121311, Price codes: A04 in paper copy, A01 in microfiche. Report submitted to Office of Water Research and Technology, October, 1980. 70 p, 13 Fig, 7 Tab.

Descriptors: *Missouri, *Research priorities, *Water quality, *Mississippi River, *Missouri River, Irrigation water, Recreation, Sewage treatment, Flood control, Energy, Mining, Budgeting, Planning, Programs, *Five-year plans.

Missouri, a state with generally abundant but varied water resources, has selected nine priority areas for research during the next five years: (1) water quality, (2) supplemental irrigation, (3) water for recreation, (4) cutting costs of sewage treatment by reducing water use, (5) impact of energy development on water, (6) impact of mineral development on water, (7) fundamental water science, and (8) flood control. Missouri is in the western-most tier of States with a generally adequate water supply. Its two major rivers, the Missouri and the Mississippi, have a major influence on the economy of the area. Missouri has a continental climate with average annual precipitation ranging from 32 to 48 inches. Water problems are categorized in terms of the Federal Coordinating Council for Science and Engineering Technology Listing of Water Resources Research Categories. Approximately 50% of the priorities are in the water quality field, 30% in planning, and 20% in the other categories. While research in the priority areas will be encouraged, mediocre research will not be permitted just because it is in a priority area. A table is included giving estimations of the use of Annual Cooperative Funding, at two levels, in each of the priority areas for the next five years. (Seigler-IPA)
W81-00286

A FIVE-YEAR PLAN FOR WATER RESOURCES RESEARCH FOR TEXAS,
Texas Water Resources, Inst., College Station.
J. R. Runkles, and J. G. McNeely.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-121303, Price codes: A05 in paper copy, A01 in microfiche. Report TR-110, October, 1980. 90 p, 5 Fig,l 9 Tab.

Descriptors: *Research priorities, *Texas, *Research and development, *Water resources development, *Water management(Applied), *Groundwater, Planning, Project planning, State jurisdiction, Water conservation, Water use, State governments, Water quality, Water supply, Flooding, Small watersheds, Water shortage, Water requirements, Water resources, Rural areas, *Five-year plans.

Present water resources uses exceed current supply by 1.2 million acre-feet (maf) and annual groundwater use exceeds the safe and firm groundwater yield by 7.1 maf. Population growth rate and its increased strain on limited water resources is a major water problem facing the State. Perceived water resources problems were categorized under flooding, groundwater depletion, water quality, and water supply and quality for small cities and rural communities. Thirteen research priorities for the Institute for the next five years were established by the Water Resources Officials Advisory Committee. The seven highest priorities were translated into specific research sub-areas and the five-year funding strategy was developed. The seven identified priorities in priority order were: (1) water conservation in agriculture; (2) drought management and related water supply disruptions; (3) groundwater management; (4) energy and water; (5) groundwater quality protection; (6) economics of surface water development and use; and

(7) flood plain management. Two-to-three research sub-areas were identified for each of the seven categories. (Zielinski-IPA)
W81-00287

THE ALLOCATION OF WATER TO INSTREAM FLOWS, VOLUME I: A COMPARATIVE STUDY OF POLICY MAKING AND TECHNICAL INFORMATION IN THE STATES OF COLORADO, IDAHO, MONTANA, AND WASHINGTON,
Lewis and Clark Coll., Portland, OR. Natural Resources Law Inst.
J. L. Huffman, M. Berry, N. Brown, N. P. Lovrich, and J. C. Pierce.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138125, Price codes: A04 in paper copy, A01 in microfiche. Final Report to the Office of Water Research and Technology. July, 1980. 24 p, 2 Fig. OWRT-C-80093-P(No 8403)(1), 14-34-0001-8403.

Descriptors: *Streamflow, *Colorado, *Idaho, *Montana, *Washington, Decisionmaking, *Water allocation(Policy), Water law, Surveys, Administrative decisions, Flow, Evaluation, Assessments, Information retrieval, Data collections, Water balance, Reviews, Documentation, Governments, Legislation.

This report, set out in five volumes, examined the impact of alternative institutional approaches for the allocation of water to instream flows, with particular examination of the role of technical information in State decision-making processes for Colorado, Idaho, Montana, and Washington. The study methods used structured interviews in Colorado and Idaho, unstructured interviews in Colorado, Montana, and Washington, and examinations of records of public agencies. This volume, Volume I, defined the scope of the overall study, presented the cumulative contents of the five volumes, and a preliminary comparative assessment for instream flow protection in the four States. The critique of the existing processes was a general one, applicable to most government decision-making on resource allocation issues. However, it was concluded that the problem was a very real one which States should address. Failure to separate technical and policy questions results in neither issue type being adequately addressed. Technical information cannot do more than inform policy makers of the probable consequences of alternative policies. Selection among policy alternatives can only be done on the basis of some measure of the values of the society that will experience the costs/benefits of the policy decision. (Zielinski-IPA)
W81-00317

THE ALLOCATION OF WATER TO INSTREAM FLOWS, VOLUME II: COLORADO WATER RESOURCES MANAGEMENT,
Lewis and Clark Coll., Portland, OR. Natural Resources Law Inst.
J. L. Huffman, and M. P. Berry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138133, Price codes: A07 in paper copy, A01 in microfiche. Final Report to the Office of Water Research and Technology, July, 1980. 97 p, 2 Fig, 24 Tab, 197 Ref, 3 Append. OWRT-C-80093-P(No 8403)(2), 14-34-0001-8403.

Descriptors: *Streamflow, *Colorado, *Water management(Applied), Water resources, *Water law, Surveys, Decisionmaking, *Water allocation(Policy), Administrative decisions, Flow, Evaluation, Assessments, Information retrieval, Data collections, Water balance, Reviews, Documentation, Governments, Legislation, Legal review.

This report represented Volume II of a five-volume report on the topic of water allocation to instream flows; the overall study also including the States of Idaho (Volume III), Montana (Volume IV), and Washington (Volume V). The overall study examined the impact of alternative institutional approaches for the allocation of water to instream flows: (1) a summary of Colorado water law with emphasis on its relation to instream flow protection; (2) results of a survey of the principal participants (judges, water referees, water lawyers) in Colorado private water rights system implementation; (3) an examination of minimum streamflow law, its history and constitutional challenges to its implementation; (4) a discussion of minimum flow law implementation; and (5) conclusions concerning operation of minimum flow law within the Colorado general appropriative rights system. Results of the survey indicated that, in general, judiciary principals were satisfied with their system of allocating water. In discussion of Colorado Senate Bill 97, it was felt that successes, from the viewpoint of those desirous of instream flow protection, have come principally from efforts of Water Conservation Board, Division of Wildlife, and Office of Attorney General individuals. (Zielinski-IPA)
W81-00318

THE ALLOCATION OF WATER TO INSTREAM FLOWS, VOLUME III: IDAHO WATER RESOURCES MANAGEMENT,
Washington State Univ., Pullman. Dept. of Political Science.
J. C. Pierce, N. P. Lovrich, Jr., and A. Cook.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138141, Price codes: A10 in paper copy, A01 in microfiche. Final Report to the Office of Water Research and Technology, July, 1980. 145 p, 3 Fig, 46 Tab, 179 Ref, 6 Append. OWRT-C-80093-P(No 8403)(3), 14-34-0001-8403.

Descriptors: *Streamflow, *Idaho, *Water management(Applied), Water resources, *Water law, Surveys, Decisionmaking, *Water allocation(Policy), Administrative decision, Flow, Evaluation, Assessments, Information retrieval, Data collections, Water balance, Reviews, Documentation, Governments, Legislation, Legal review.

This report represented Volume III of a five-volume report on the topic of water allocation to instream flows; the overall study also including the States of Colorado (Volume II), Montana (Volume IV), and Washington (Volume V). The overall study examined the impact of alternative institutional approaches for allocation of water to instream flows. The Idaho section (Volume III) of this report examined the role of technical information in Idaho water resources management policy-making processes, and the degree to which policy preferences of the public were reflected in preferences of political activists and Idaho State legislators. Special questionnaire surveys were conducted, with response efficiencies of 68 to greater than 70 percent. The level of information holding was found to be generally distributed across legislature, independent of political/environmental orientation of the individual members. Also, it appeared that evaluations of technical information by legislators were extremely political, with legislators trusting information derived from sources most closely matching their own. Three representative groups of attentives in the public were identified. Not only the magnitude of the differences, but the direction as well, was relatively consistent between the groups. (Zielinski-IPA)
W81-00319

THE ALLOCATION OF WATER TO INSTREAM FLOWS, VOLUME IV: MONTANA WATER RESOURCES MANAGEMENT,
Lewis and Clark Coll., Portland, OR. Natural Resources Law Inst.
J. L. Huffman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138158, Price codes: A12 in paper copy, A01 in microfiche. Final Report to the Office of Water Research and Technology, July, 1980. 197 p, 4 Fig, 16 Tab, 191 Ref, 7 Append. OWRT-C-80093-P(No 8403)(4), 14-34-0001-8403.

Descriptors: *Streamflow, *Montana, *Water management(Applied), Water resources, *Water law, Surveys, Decisionmaking, *Water allocation(Policy), Administrative decisions, Flow evaluation, Assessments, Information retrieval, Data collections, Water balance, Reviews, Documentation, Government, Legal review, Legislation.

This report represented Volume IV of a five-volume report on the topic of water allocation to instream flows; the overall study also including the States of Colorado (Volume II), Idaho (Volume III), and Washington (Volume V). The overall study examined the impact of alternative institutional approaches for the allocation of water to instream flows. The Montana report (Volume IV) on this study covered an examination of Montana water law; topics of minimum flow preservation under Montana law, the Yellowstone Reservation hearings, municipal reservations, agricultural applications, and instream applications; a discussion of the overall legal process; and an assessment of the future of water reservations in Montana. Twenty principal recommendations of this study were made in six categories: the law, technical issues, process design, role of the Board of Natural Resources and Conservation, reservation orders, and the reservation issue. Recommendation under the law category urged the Board continue its policy-making function in implementing the reservation statute and take a broad and aggressive approach in review of established reservations; and under technical data, such data should be format-structured to allow the Board to assess probable impacts of alternative reservation decisions. (Zielinski-IPA)
W81-00320

THE ALLOCATION OF WATER TO INSTREAM FLOWS, VOLUME V: WASHINGTON WATER RESOURCES MANAGEMENT,
Lewis and Clark Coll. Portland, OR. Natural Resources Law Inst.
N. C. Brown, and P. S. Wassenberg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138166, Price codes: A05 in paper copy, A01 in microfiche. Final Report to the Office of Water Research and Technology, July, 1980. 54 p, 9 Fig, 6 Tab, 104 Ref, 3 Append. OWRT-C-80093-P(No 8403)(5), 14-34-0001-8403.

Descriptors: *Streamflow, *Washington, *Water management(Applied), Water resources, *Water law, Surveys, Decision making, *Water allocation(Policy), Pacific Northwest U.S., Administrative decisions, Flow, Evaluation, Assessments, Information retrieval, Data collections, Water balance, Reviews, Documentation, Governments, Legislation, Legal review, Pacific coast region.

This report represented Volume V of a five-volume report on the topic of water allocation to instream flows; the overall study also including the States of Colorado (Volume II), Idaho (Volume III), Montana (Volume IV). The overall study examined impact of alternative institutional approaches for the allocation of water to instream flows. The State of Washington report (Volume V) on this study covered Washington State water law, past and present status of instream flows, the Western Washington Instream Resources Protection Program (WWIRPP), the controversy on protecting versus preserving fishery resources, Federal and Indian reserved rights, State resource management of the Columbia River, and the Columbia River Instream Resources Protection Program (CRIRPP). A summary of findings covering the study areas was presented. Decisions by Washington State decision-makers on instream flows appeared to be based more on scientific than political factors, but political influences were judged involved in the process (such as the Department of Energy, DOE, establishment of instream flows on streams and lakes, initiated by the Washington legislature). The rapid development and implementation of the WWIRPP and CRIRPP activities demonstrated that DOE action over the last two years has established instream flows as a high priority. (Zielinski-IPA)
W81-00321

A FIVE-YEAR PLAN FOR WATER RESOURCES RESEARCH AND ASSOCIATED TECHNOLOGY TRANSFER NEEDS,
Idaho Univ., Moscow. Water Resources Research Inst.

C. C. Warnick, and W. Reynolds.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124489, Price codes: A02 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, October 1980. 22 p, 18 Ref, 1 Append.

Descriptors: *Idaho, *Research priorities, *Water conservation, Volcanoes, Irrigation water, Social impact, Environmental effects, Groundwater recharge, Energy, Wildlife, Fish passages, Planning, Water demand, Flow characteristics, *Five-year plans.

Idaho has identified five categories of research priorities: energy, irrigated agriculture, environmental, institutional and social, and water conservation. Energy related research will include the evaluation of specific pumped storage sites, new technology for moderate to low temperature geothermal water, and the development of more sophisticated river and reservoir management models. Irrigated agriculture research will include erosion control groundwater recharge, cost and energy effectiveness, irrigation practices, and irrigation facilities. Included in environmental research will be specific wildlife habitat requirements, volcanic ash impact, improved fish passages at dams, the defining of instream flow requirements, and the evaluation of Idaho lake ecosystems. Institutional and social concerns will include attitude evaluations, water right policies and laws, and the effectiveness of various administrative units. Water conservation research will include the potential for artificial aquifer recharge, the impacts of alternative water conservation policies, and improved methods for predicting irrigation water demands. Technology transfer will be a major concern in all five of the priority areas. (Seigler-IPA)
W81-00330

WATER RESOURCES RESEARCH FIVE-YEAR PLAN/1982-1987,
North Dakota Water Resources Research Inst., Fargo.
L. Lubka.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124497, Price codes: A05 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, 1980. 71 p, 1 Fig, 8 Tab, 24 Ref, 1 Append.

Descriptors: *North Dakota, *Research priorities, *Planning, *Research and Development, *Water management(Applied), *Water utilization, Wetlands, Genetics, Crop response, Groundwater availability, Waste water(Pollution), Flood plains, Flood plain zoning, Flood control, Water conservation, Water distribution(Applied), Institutions, Optimum development plans, Water policy, Water supply, *Five-year plans.

This report has outlined the water resources background of North Dakota, including geology, hydrology, meteorology, water data availability, and problem awareness. Trends in water consumption, water-related problems, and the significant recent studies concerning water and land resources were examined. Identified problem areas were: inadequate surface water supply; overdraft of groundwater; pollution of surface water; pollution of groundwater; drinking water quality; flooding; erosion and sedimentation; and wetlands. A review of these problem areas led to a ranking of seventeen North Dakota problem categories/research priorities. The highest ranked of these was flood plain management, which was the highest ranked topic for relevance to State problems, capability of State to conduct research, probability of making a significant contribution, and cost/benefit. Flood plain management was followed in ranking order by water conservation; genetic engineering of agricultural plants; waste water management; groundwater management; water distribution; stream flow; wetlands management; land-use planning; public participation/information dissemination; institutional framework; saline water; geothermal water; weather modification; nature of water; acid rain; and hydroelectric power. (Zielinski-IPA)
W81-00331

FIVE YEAR RESEARCH PLAN, 1982-1987,
Kansas Water Resources Research Inst., Lawrence.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124505, Price codes: A04 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, October 1980. 67 p, 8 Fig, 4 Tab, 19 Ref.

Descriptors: *Kansas, *Research priorities, *Water conservation, *Water quality, Management, Grants, Budgeting, Pumping, Irrigation water, Enchroachment, Saline water, Toxicity, Planning, Arkansas River, *Five-year plans.

Kansas has a research program focused on water conservation, water quality protection, water management, and basic research. The State's annual precipitation averages between 17 and 40 inches depending upon location. This gives approximately 105 million acre-feet from precipitation annually. Kansas uses about 5.5 million acre-feet of its annual pumpage of 7 million acre-feet for irrigated agriculture. Aquifers are gradually being depleted as recharge is not keeping up with demand, especially in the western part of the State. Shallow wells drilled along streams have caused some, such as the Arkansas River, to cease flowing most of the year. Salt intrusion is also becoming a problem due to heavy pumping in areas such as Wichita. Conservation research will involve agriculture, industry, municipalities, recreation, wildlife, and fisheries. Water quality studies will include the sources and pathways of toxic chemicals, salt water intrusion, best management for stream quality, and sedimentation. Issues to be studied under water management include: legal and institutional aspects; economic, political, and social impacts; and interactions in hydrologic systems. It is projected that funding will go 28.6% to water conservation, 28.6% to water quality protection, 28.6% to water management, and 14.2% to basic research. (Seigler-IPA)
W81-00332

FIVE-YEAR WATER RESEARCH AND DEVELOPMENT PLAN FOR GUAM AND MICRONESIA FY 82 THROUGH FY 86,
Guam Univ., Agana. Water Resources Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-125122, Price codes: A05 in paper copy, A01 in microfiche. Report, submitted to the Office of Water Research and Technology, October 1980. 78 p, 9 Fig, 6 Tab, 198 Ref.

Descriptors: *Guam, *Research priorities, *Saipan, *Micronesia, Limestone, Groundwater, Islands, Planning, Projects, Pacific Ocean, Tropical regions, Hydroelectric power, Volcanoes, Waste water treatment, Water demand, *Five-year plans.

A common problem and water research priority for Guam, Saipan, and Micronesia is groundwater yield. Guam gives secondary priority to baseline water quality data and the impact of pollutants on receiving water quality. Tertiary priorities for Guam are water demand, potential conflicts over surface water use, and the feasibility of low-head hydroelectric power generation. Saipan gives secondary priority to baseline water quality data and Micronesia gives secondary priority to the operation of waste water treatment plants and conservation. Guam is within the tropical belt and is the largest of the Mariana Islands with a land area of about 212 sq mi. Northern Guam has a broad limestone plateau and the southern half is a dissected volcanic upland fringed with limestone. These limestone areas have high hydraulic conductivity and porosity. Almost all residences on Guam are served by the public water system with a total productivity from all sources of 28.5 million gallons per day. The five-year plan includes information on the problems to be researched, the five-year schedule, and the distribution of funding among the projects based on two levels of Annual Cooperative Funding: $115,000 and $250,000. (Seigler-IPA)
W81-00333

FIVE YEAR RESEARCH AND DEVELOPMENT PLAN FOR THE RHODE ISLAND WATER RESOURCES CENTER,
Rhode Island Univ., Kingston. Water Resources Center.
W. E. Kelly.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124182, Price codes: A03 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, September 1980. 28 p, 3 Fig, 1 Tab, 7 Ref.

Descriptors: *Rhode Island, *Research priorities, *Hazardous wastes, *Urban runoff, Research facilities, Planning, Technology transfer, Flooding, Water shortages, Groundwater, Water supply, Human population, Reservoirs, *Five-year plans.

Rhode Island will focus its research on urban runoff, hazardous waste, and technology transfer. Rhode Island, the smallest State, is one of the most densely populated. Many of today's water problems are left from early industrial development based on relatively abundant waterpower. Major rivers are the Branch, the Blackstone, the Woonasquatucket, the Pawtuxet, the Potowomut, the Moosup, the Tenmile, the Warren, the Pawcatuck, and the Saugatucket. Average annual precipitation varies from 40 to 50 inches depending on location. Seventeen groundwater reservoirs have been identified. Chronic water shortages exist in the southeastern part of Rhode Island while flooding is a problem in the Pawtuxet and Blackstone River Valleys. A multi-disciplinary approach will be used to coordinate research in the areas of runoff and hazardous waste. There is very little research on-going on the number one problem of hazardous waste. Funding at two different levels is shown for the major categories and subcategories in the Five-Year Research Plan. (Seigler-IPA)
W81-00334

FIVE-YEAR PLAN FOR THE LOUISIANA WATER RESOURCES RESEARCH INSTITUTE, 1980-85,
Louisiana Water Resources Research Inst., Baton Rouge.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124190, Price codes: A02 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, October 1980. 14 p, 2 Fig, 2 Tab.

Descriptors: *Louisiana, *Research priorities, *Research facilities, *Project planning, Institutions, Waste water disposal, Water conservation, Desalination, Water reuse, Water law, Environmental effects, Subsidence, Aquifer management, *Five-year plans.

Thirteen priority water research areas are identified for Louisiana: (1) effects of surface waste water disposal, (2) deep well waste disposal, (3) water conservation, (4) desalting, (5) water reuse, (6) energy-related water use, (7) groundwater, (8) aquifer management, (9) urban water, (10) environmental protection, (11) rural water, (12) water law, and (13) subsidence. A five year funding summary of the probable minimum expansion of work at the Institute is given along with a five year projection of staff and space requirements. Current research projects at the Institute totaling $349,507 include: Algae Removal by Fine Sand/Silt Filtration, Impact of Lignite Mining on Water Resources in Louisiana, Stochastic Analyses of Predictive Biochemical Oxygen Demand Kinetics, and Utilization of the Lime Byproduct from Water Softening for Waste Water Treatment. A list of 51 current Institute publications is attached. (Seigler-IPA)
W81-00335

FIVE-YEAR PLAN OF THE PUERTO RICO WATER RESOURCES RESEARCH INSTITUTE,
Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
R. M. Candelario.
Available from the National Technical Information

Service, Springfield, VA 22161 as PB81-126542, Price codes: A05 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, October, 1980. 90 p, 21 Fig, 24 Tab, 15 Ref.

Descriptors: *Puerto Rico, *Research priorities, *Research and development, *Planning, *Water management(Applied), *Water utilization, Water resources development, Water supply, Water quality, Water reuse, Water distribution(Applied), Institutions, Water policy, Optimum development plans, Toxins, Water pollution, Water purification, Water balance, Waste water(Pollution), Basins, *Five-year plans.

Preparation of this plan has responded to the mandate of the Water Research and Development Act of 1978 (P.L. 95-467). Both surface and groundwater supplies were deemed adequate for existing/future needs, but current planning and management practices are inadequate, and water shortages often arise in the agricultural/industrial/municipal sectors. The most urgent needs in water resources research in Puerto Rico were identified as lying mainly within the general categories of management, quality and reuse of water. The identified high-priority research problems to be investigated by the Institute during the five-year period were placed under five different categories: (1) atmospheric, hydrological, and hydraulic processes; (2) hydrological-ecological relationships; (3) water quality management and protection; (4) water development, use, conservation and management; and (5) institutional and economic analysis and water resource planning. Identified high-priority research problems included: water balances and models for basins (under category 1); land application of waste waters (category 2); hydrologic cycle toxic/hazardous pollutant identification (category 3); reuse options for waters of impaired quality (category 4); and island-wide total water resources management plan (category 5). (Zielinski-IPA)
W81-00336

NEBRASKA WATER RESOURCES CENTER FIVE-YEAR WATER RESOURCES RESEARCH PROGRAM, 1982-1987,
Nebraska Water Resources Center, Lincoln.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124356, Price codes: A06 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, October, 1980. 86 p, 13 Fig, 2 Tab, 26 Ref.

Descriptors: *Nebraska, *Research priorities, *Research and development, *Water resources development, *Planning, *Water management(Applied), *Water utilization, Water supply, Water quality, Groundwater, Groundwater availability, Optimum development plans, Crops, Precipitation(Atmospheric), Water distribution(Applied), Surface waters, Surface-groundwater relationships, Institutions, Water policy, Groundwater resources, *Five-year plans.

Nebraska ground and surface water systems were estimated to contain approximately two billion acre-feet of water, and its long-term average precipitation to be 86 million acre-feet. Despite abundant water resources, not all areas of the State have an adequate or useful water source. Nebraska State water problems have been identified under five categories: water quantity; water quality; distribution and redistribution; water use efficiency and productivity; and legal-institutional. Some State areas have limited groundwater and no access to lakes/streams. Nebraska's Section 208 Water Quality Management Plan lists eleven sources of State water quality problems, with sedimentation identified as the most important. Water distribution problems result from climatic variability and differential access to State water supplies. A greater research effort is needed to use species of crops which are more water efficient to enhance overall water use efficiency/productivity. While legal-institutional arrangements provide the framework for water resources utilization and management, Nebraska has no current statutory/constitutional basis for establishing groundwater ownership, and public management systems do not recognize the interrelationships between ground and surface water. Nineteen specific research topics were developed to address the identified priority Nebraska water resources problems. (Zielinski-IPA)
W81-00337

WATER RESOURCES RESEARCH SUPPORT PROGRAM 1979-1980,
Inland Waters Directorate, Ottawa (Ontario).
1980, English and French, 14p.

Descriptors: *Water resources, *Research, Sediments, Pollutants, Groundwaters, *Canada, *Universities, Hydrologic modelling, Hydraulics, *Water systems, Data collection, Technology, Snow, Ice.

The Department of the Environment, on the recommendation of the Water Resources Research Support Program Review Group, has agreed to provide a total of $250,000 for water-related environmental research during 1979-80 to the Canadian university research community. The Water Resources Research Support Program provides for innovative research relevant to departmental concerns and responsibilities for water resources research in the natural and social sciences with emphasis on water management issues. By fostering the interest of university researchers, it thereby utilizes their knowledge and expertise in solving water research problems and provides opportunities for their participation in socially relevant environmental research. Sixteen universities across Canada will share the $250,000 which will be used to support interdisciplinary research programs aimed at solving regional and national water research issues. The areas of study and the institutions involved are included. (WATDOC)
W81-00383

WATER RESOURCES RESEARCH - THE EARLY YEARS,
New Mexico State Univ., Las Cruces.
H. R. Stucky.
In: A Quarter Century of Water Research. Proceedings of the Twenty-Fifth Annual New Mexico Water Conference, Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 7-19. New Mexico Resources Research Institute, New Mexico State University, Box 3167 Las Cruces, NM 88003.

Descriptors: *New Mexico, *Research and development, *Water Resources Research Act, *Water resources development, *Water supply, Institutions, Conference, Legislation, Planning, Prior appropriation, Water rights, Surface water.

Water is required by all life and influences all factors of the environment. All segments of society must share in the proper use of water and the control of pollution. Partial solutions to water resources problems have been started but much multidisciplinary research is necessary. Archaeologists have found centuries-old evience of water management by the Indians in New Mexico. The principles of prior appropriation---public ownership of surface water with rights assigned by prior appropriation and beneficial use---were applied to groundwater in 1931 by New Mexico law. Senate Bill S-2, the Water Resources Research Act of 1964, was signed on July 17, 1964 and established Water Resources Research Centers in each of the 50 states and Puerto Rico. These institutes began adding to the research already conducted by the Agricultural and Engineering Experimental Stations and various government and private agencies. One year prior, in 1963, the New Mexico State University Water Research Institute was authorized and thus became the first state institute in the nation. The first 8 annual New Mexico Water Conferences, from 1956-1963, were the forerunners of the Institute. The Institute's statewide responsibilities, methods of research and objectives are reviewed. A discussion of the Institute's policies regarding funding, means of contact, working relationships, and agreements made with governments, scientists and supporting organizations is presented. (Atkins-Omniplan)
W81-00391

A HISTORICAL PERSPECTIVE OF WATER MANAGEMENT IN NEW MEXICO,
New Mexico Interstate Stream Commission, Santa Fe.
S. E. Reynolds.
In: A Quarter Century of Water Research. Proceedings of the Twenty-Fifth Annual New Mexico Water Conference. Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 20-32. New Mexico Resources Research Institute, New Mexico State University, Box 3167 Las Cruces, NM 88003.

Descriptors: *New Mexico, *Water law, *Water resources, *Water management(Applied), *Judicial decisions, Water utilization, Competing uses, Diversion, Preferences, Non-riparian waters, Beneficial uses, Prior appropriation, Riparian rights, Federal project policy.

The last 25 years of water management in New Mexico have been shaped by significant court decisions and interpretations of the statutes: the statues are based on the appropriation doctrine rather than the riparian doctrine of water rights. Surface water codes were codified in 1907 and affirmed in the state construction of 1911. Ground water codes were applied in 1931. Twenty six other states have been influenced in their approach to water management. Sixty state supreme court decisions in the last 25 years attest to the activity. The statutes and decisions have shaped public use as well as economic enterprise, based on the principles of beneficial use weighing considerations of equity and the time of use for rights. The state engineer's every decision, act or refusal to act is subject to appeal to district court. In New Mexico a water right is a property right. State versus Federal controversy over instream flows is clear in New Mexico: there can be no instream water right. (Meade-Omniplan)
W81-00392

MINE DEWATERING,
M. B. Campbell.
In: A Quarter Century of Water Research. Proceedings of the Twenty-Fifth Annual New Mexico Water Conference. Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 175-180. New Mexico Resources Research Institute, New Mexico State University, Box 3167 Las Cruces, NM 88003.

Descriptors: *Mine water, *Water treatment, *Legal aspects, *Mining, *Mine Dewatering Act, *New Mexico, Surface water, Uranium, Mining, Equitable apportionment, Water appropriation, Ion-exchange, Mineral industry, Water permits, Legislation.

A mine dewatering controversy exists in New Mexico which focuses on the uranium industry. The extraction or discharge of water encountered in mineral production is necessary in several mining operations. Federal and state water quality standards require mining companies to clean water prior to discharging it at the surface. The New Mexico Department of Energy estimates that by the mid-1980's New Mexico will have 72 active uranium mines each discharging water in quantities of approximately 90 cu/ft/sec. The uranium industry's cleaning process is accomplished with an ion-exchange which allows uranium particles to drop out of the water, thus determining the water to be of beneficial use. Since no permit of appropriation was granted, as required by the state for the beneficial-use water, significant legal effects exist. In 1980, the Mine Dewatering Act was passed which subject mine dewatering companies to the jurisdiction of the State Engineer. They will also be given the right to replace the water of other water owners whose activity is imparied. Providing a plan of implementation is approved, the Mine Dewatering Act of New Mexico provides flexibility, prevents companies from dewatering for the entire lifetime of the mine and maintains traditional doctrines of appropriation. (Vernale-Omniplan)
W81-00398

DISPUTES OVER WATER QUALITY POLICY: PROFESSIONAL CULTURES IN CONFLICT, 1900-1917,
Carnegie-Mellon Univ., Pittsburgh, PA.

For primary bibliographic entry see Field 5F.
W81-00407

SHOULD I ARBITRATE OR LITIGATE.
P. J. Sullivan.
Water and Sewage Works, Vol 127, No 10, p 37, 59, October, 1980.

Descriptors: *Contracts, *Claims(Contracts), *Municipal water, Specifications, Legal aspects, Sewerage, Performance, Supply contracts, Design, Construction, Judicial decisions, Legal review.

Some contract disputes may be resolved by the parties attempting to find solutions rather than faults, avoiding, wherever possible, the intervention of lawyers, while some can be avoided by drawing up contracts and working agreements that leave little room for argument. A contract usually specifies sewer size and bedding type and contains other statements to the effect that the contractor must follow the owners' specifications. Some municipalities wrongly attempt to force the contractor to accept responsibility for all eventualities while at the same time retaining complete control. Courts generally frown upon clauses stating that the owner has a right to take the job away from a contractor if the latter does not perform as specified under certain circumstances. The author recommends a letter of credit rather than a bond as a guarantee that the contractor will perform as required. If a dispute brings about a law suit, it is then the bank that is sued. An unconditional letter of credit implies that the bank must not involve itself in a dispute, though the bank is entitled to pay the money to the owner or to pay the money to the court if the bank is sued. (Gish-FRC)
W81-00444

SHIPPING IN THE BALTIC,
Handelshogskolan i Stockholm (Sweden).
G. Alexandersson.
Ambio, Vol 9, No 3-4, p 158-162, 1980. 5 Fig, 11 Ref.

Descriptors: *Ships, *International commissions, *Recreation wastes, *Water pollution control, Harbors, Transportation, Ferry boats, Water pollution sources, Marinas, Boating, Waste water treatment, Commercial fishing, Baltic Sea, Oceans.

The effects of changing trends in shipping on water pollution control in the Baltic Sea are discussed. Since 1950, ships have increased in size, speed, and in level of specialization, yet have decreased in number. The Great Belt, a Danish transit route, has become the primary passageway from the North Sea to the Baltic, because its depth can accommodate modern ships. All shipping services have become automated. Passenger transport has declined, while ferry traffic has increased in conjunction with road traffic. In the Soviet Union, Baltic ports are favored over Black Sea ports for general cargo trade, and, within the Scandinavian countries, the number of dominant ports is declining. These trends reduce the number and simplify the building of port installations needed to comply with international agreements on the control of water pollution. Increases in water-oriented recreation may provide popular support for costly water quality measures, yet may create new shipping problems and new demands for Baltic water pollution control facilities. (Titus-FRC)
W81-00448

WATER-RELATED ENVIRONMENTAL FACTORS,
Inland Waters Directorate, Edmonton (Alberta).
R. J. Lane.
In: Proceedings of the Technology Transfer Workshop, Environmental Impact Assessment in the North, Oct 31, Nov 1-2, 1978. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 1, p, 9, 101-106, 1979.

Descriptors: *Environmental impact assessment, *Arctic, *Northern development, *Environmental effects, Planning, Water quality, Water pollution, Administration, Water supply, Flow, Rivers, Sediment transport, Canada.

Costly, accelerated response by government to northern developmental assessment is still evolving, but it is clear that IWD has responsibilities in the process to provide advice to an initiator's development of an initial environmental evaluation (IEE), to provide staff to serve on environmental assessment panels, to assist in the preparation of guidelines for invironmental impact statements (EIS), and to evaluate EIS reports. No IWD studies are needed except when paid for by an initiator or when IWD is incapable or providing sound advice. For water quantity, federal interests are interprovincial flows or international commitments, the latter including factors relating to waterfowl and climate. A change in flow trend because of development could also create an inventory concern. Concerns related to sister agencies in the north are flood demaged, changes in navigable waters and threatened waterfowl or fish habitat. Pertinent water quality concerns are in interprovincial or international waters. In addition, contaminantion by toxic substances requires problem definition, as well as parameter sampling and predictive model evaluation. Other quality concerns are radioactivity, eutrophication, oil spills and waste heat disposal. Additional network development for impact assessment should be minimal and preferably cost-shared with provincial or territorial governments. (WATDOC)
W81-00458

6G. Ecologic Impact Of Water Development

WATER RESOURCES OF THE RIO GRANDE AN INTERDISCIPLINARY APPROACH,
New Mexico State Univ., Las Cruces.
For primary bibliographic entry see Field 6A.
W81-00394

THE ARTIC ISLANDS PIPELINE PROJET: ITS GOALS, OBJECTIVES AND PROGRAM DEVELOPMENT FOR FRESHWATER PROJECT NO. 1,
Inland Waters Directorate, Winnipeg (Manitoba).
J. E. Slater.
In: Proceedings of the Technology Transfer Workshkop, Environmental Impact Assessment in the North, Oct 31, Nov 1-2, 1978. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 1, p 7-8, 97, 1979,

Descriptors: Geomorphology, Hydrologic properties, Keewatin district, Spence Bay, Canada.

The terms of reference supplied to the study group were to examine the effects of a buried gas pipeline on river crossings. Because of provincial jurisdiction, study was confined to regions north of 60 degrees latitude. The principal constraints on the study were time and money. The time period of 2-3 years made available was insufficient to obtain data for hydrologic and geomorphic parameters in the usual way which normally relies on statistical analysis for sampling periods in excess of 10 years. The absence of any hydrologic network north from the Keewatin district (one station on Cornwallis Island) made data transfer techniques untenable. However, it was possible to provide a qualitative description of river features based on map studies, airphoto analysis, and spot sampling of pertinent parameters at 27 selected river sites visited on two reconnaissance surveys, sampling information, later assembled in a stream catalogue, described streamflow, sediment concentration, bed and bank material, ground-ice conditions, floodplain characteristics, river slope and valley-wall approaches. Aside from their value the data assisted researchers in associated disciplines. Not very much hard data resulted from these stuidies, but examination of fluvio-morphologic processes active in the barrenland permafrost regions permitted the tentative definition of some areas thought to be environmentally sensitive to pipeline activity. (WATDOC)
W81-00457

7. RESOURCES DATA

7A. Network Design

MICROBIOLOGICAL WATER AND EFFLUENT SAMPLE PRESERVATION,
Canada Centre for Inland Waters, Burlington (Ontario).
B. J. Dukta, and A. El-Shaarawi.
Canadian Journal of Microbiology, Vol 26, No 8, p 921-929, August, 1980. 6 Tab, 8 Ref.

Descriptors: *Water sampling, *Water storage, *Water temperature, *Aquatic bacteria, *Bioassay, Coliforms, Streptococcus, Sewage bacteria, Analytical techniques, Membrane processes, Municipal wastes, Domestic wastes, Industrial wastes, Pulp wastes, Streams.

The effect of storage temperature on four water samples (relatively pure stream water, water containing municipal sewage, a canal containing industrial wastes including pulp and paper effluents, and the unchlorinated effluent from a sewage treatment plant) was studied to ascertain whether the period between sample collection and sample analysis could be extended without significantly affecting bacterial populations. Bacteria tested were total coliform (TC), fecal coliform (FC), fecal streptococcus (FS), and heterotrophic bacteria (HB). Each water sample was cooled immediately after collection to approximately 1.5 C by storage in crushed ice. After 2, 24, 30, and 48 hours, the sample was homogeneously mixed, and a subsample was tested. Analysis of variance was performed on the replicated data and on the entire data set. The results indicated that original water temperature does not seem to be a consistent factor in the preservation of microbiological water samples; over 75% of samples tested for TC, FC, and FS were microbiologically stable for at least 24 hr in melting-ice conditions. At least 42% of samples were stable for 48 hours. HB density was the least stable, with at least 30% and 50% of analyses being stable at 48 and for at least 24 hours, respectively. The results demonstrate that natural water samples to be tested for TC, FC, FS, and HB can be preserved for 24 hours without significantly changing microbiological characteristics. (Gish-FRC)
W81-00255

MORPHOMETRIC AND HYDRAULIC DATA COLLECTION PROGRAMS,
Water Survey of Canada, Ottawa (Ontario).
J. G. Way.
In: Proceedings of the Technology Workshop, Environmental Impact Assessment in the North, Oct 31, Nov 1-2, 1978. Inland Waters Directorate, Ottawa, Ontario, Canada, Technical Workshop Series No 1, p 13, 123-124, 1979.

Descriptors: *Environmental impact assessment, *Arctic, *Northern development, *Environmental effects, Data collections, Hydrologic properties, Hydraulic properties, Maps, Sampling, Photo analysis, Measurement, Arctic islands, Pipelines, On-site data collections, Canada.

This talk describes data assembly techniques used in the Arctic Island Pipeline Program. Site selection was by map and airphoto analysis, as was the assembly of data on chosen sites for stream order, hypsometric coefficients, integrals, basin area, river length, basin perimeter length and width. In the field, samples were obtained of suspended sediment, bed material, streamflow, water quality and thaw depth. Qualitative assessemtn of surrounding terrain was made on prepared forms. Hydraulic channel properties were measured. Subsequent analysis suggested possible flood magnitudes for studied sites. To incorporate these procedures into regular programs requires staff training. (WATDOC)
W81-00461

7B. Data Acquisition

DIRECT DETERMINATION OF LEAD IN POLLUTED SEA WATER BY CARBON-FURNACE ATOMIC ABSORPTION SPECTROMETRY,
Napier Coll. of Commerce and Technology, Edinburgh (Scotland). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W81-00253

SPECTROPHOTOMETRIC DETERMINATION OF TRACES OF COBALT IN WATER AFTER PRECONCENTRATION ON REAGENT-LOADED POLYURETHANE FOAMS,
Eotvos Lorand Univ., Budapest (Hungary). Inst. of Inorganic and Analytical Chemistry.
T. Braun, and M. N. Abbas.
Analytica Chimica Acta, Vol 119, No 1, p 113-119, September 1, 1980. 1 Fig, 5 Tab, 23 Ref.

Descriptors: *Water analysis, *Cobalt, *Trace elements, *Spectrophotometry, *Foam fractionation, Separation techniques, Analytical techniques, Filtration, Absorption, Testing.

A simple, inexpensive and rapid method for the preconcentration of traces of cobalt from large volumes of water on reagent-loaded polyurethane foam columns prior to spectrophotometric determination of the cobalt is described. Open-cell polyurethane foam loaded with 1-(2-pyridylazo)-2-naphthol (PAN) was used to concentrate cobalt from a parts per billion level in water with a concentration factor of 1000 or more. Cobalt was retained quantitatively from thiocyanate solution on the loaded foam placed in a column and recovered completely from the foam by elution with acetone. Spectrophotometric determination of cobalt was carried out with 4-(2-pyridylazo)-resorcinol at 510 nm after interfering ions were removed with a Dowex 1-X8 column. The results for the determination of 1.0 micrograms of cobalt in the presence of 10.0 micrograms of nickel and 20.0 micrograms of iron before and after the Dowex column separation indicated good recovery rates for cobalt with column separation. (Baker-FRC)
W81-00254

A SIMPLIFIED AUTOMATED CHELOMETRIC METHOD FOR THE DETERMINATION OF SULFATE IN INTERSTITIAL WATER AND SEAWATER,
Quebec Univ., Rimouski. Dept. of Oceanography.
J. Lebel, and N. Belzile.
Marine Chemistry, Vol 9, No 4, p 237-241, August, 1980. 1 Fig, 3 Tab, 7 Ref.

Descriptors: *Chelation, *Connate water, *Automation, *Sulfates, *Chemical precipitation, Sea water, Volumetric analysis, Electrodes, Analytical techniques, Chemical analysis.

A method is described whereby sulfate can be determined in interstitial water and in seawater. The method calls for the precipitation of barium sulfate. Excess barium is then titrated with ethylenediaminetetraacetic acid using an amalgated silver electrode for end-point detection. This determination is as accurate as the classical gravimetric method used and is valuable due to the simplicity and small sample requirements. The value of using small samples becomes particularly clear when analyzing interstitial water samples. An accuracy of better than 0.5% is obtained with this method. (Baker-FRC)
W81-00256

AN INSTRUMENTED LYSIMETER SYSTEM FOR MONITORING SALT AND WATER MOVEMENT,
Science and Education Administration. Kimberly, ID. Snake River Conservation Research Center.
For primary bibliographic entry see Field 2G.
W81-00273

A REMOTE MONITORING SYSTEM FOR WATER QUALITY PARAMETERS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
E. D. Hart, and B. W. McCleave.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 89-90, (1979) 3 Fig.

Descriptors: *Remote sensing, *Monitoring, *Waves(Water), Data processing, Data collecting, Computer programs, Algorithms, Equipment, Measurement, Parametric hydrology, *Water quality, Microprocessors, Electronic equipment, Data transmission.

A remote wave monitoring system has been developed to study wave action, a major contribution to streambank damage. The system uses a microprocessor with state-of-the-art low-power components. It functions unattended, uses less than 10 watts of power, and the batteries may be charged by solar cells. A Texas Instrument 733 cassette tape with a low-power Memodyne recorder is used to store 35 days worth of data. Data can be printed on any Silent 733 terminal or transmitted over telephone lines. Time of day is recorded for synchronization and comparison. The hardware utilizes two printed circuit boards, a commercially available board and a Waterways Experiment Station Input and Output board. There are several software utility packages to allow modular program development. Algorithms which fit the application are used for data processing. The best algorithm for wave height analysis is yet to be determined. At present the system is being laboratory tested. With debugging it will become a valuable tool that can be adapted to almost any water quality parameter. (See also W81-00290) (Seigler-IPA)
W81-00307

SURGE TANK WATER LEVEL VARIATIONS FOLLOWING RAPID VALVE OPENING,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Civil Engineering and Building Technology.
P. W. France.
Advances in Water Resources, Vol 3, No 1, p 41-43, March, 1980. 3 Fig, 8 Ref.

Descriptors: *Surge tanks, *Surges, *Mathematical models, *Water levels, Valves, Equations, Measurement, Instrumentation, Pipelines, Penstocks, Energy, Engineering structures, Flow, Water flow, Flow rates, Model studies, Hydraulic models.

Experimental values for maximum downsurge following rapid valve opening in a model surge tank were investigated over a range of flow rates employing a modified initial value technique. Movement of the water surface in the surge tank after valve opening may be calculated for any time after valve closure by an energy equation where the length and area of the supply tunnel and velocity through the tunnel are known. The basic equations may be reapproached in the finite difference form, where changes in tank levels may be determined. A desk top calculator linked to a graph plotter was programmed to give a visual display of the finite difference solutions. By applying a predictor-corrector technique, an average gradient over the time interval may be generated to yield closer approximation to the actual curve than the tangential straight lines obtained from the simple initial value method. Results indicated that, for this type of Perspex surge tank, a great deal of the water flowing in the penstock following rapid valve opening originates from the supply tunnel; this should therefore be considered in any calculations. (Geiger-FRC)
W81-00409

MASS FRAGMENTOGRAPHIC DETERMINATION OF POLYMETHYLNAPHTHALENE AND POLYMETHYLPHENANTHRENE IN A CRUDE OIL AND IN MARINE ORGANISMS,
Hyogo Prefecture Public Health Inst., Kobe (Japan).
K. Adachi.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 416-423, September, 1980. 4 Fig, 2 Tab, 16 Ref.

Descriptors: *Oil, *Oysters, *Mass fragmentography, Marine animals, Chromatography, Analytical techniques, Gas chromatography, Mass spectrometry, Water pollution effects, Oil pollution, Organic compounds, Separation techniques.

An activated charcoal chromatographic separation procedure for polymethylnaphthalene (PMN) and polymethylphenanthrene (PMP) in crude oil and a mass fragmentographic method for the quantitative determination of trace levels of these compounds in marine organisms are described. Tissue samples were homogenized and then saponified for 3 hr followed by filtration and extraction with n-hexane. Extracts were subjected to Florisil column cleanup and the eluate was concentrated before undergoing activated charcoal column chromatographic separation. Each eluate from the charcoal column was analyzed by gas chromatography-mass spectrometry. Biogenic compounds and ambiguous pollutants interferred with gas chromatographic analysis of marine organisms exposed to petroleum contamination at levels as low as a few micrograms/g. The single ion detection attachment was used during mass fragmentographic analyses for PMN and PMP. Ranges of PMN and PMP products in 0.5 mg of a crude oil and 50 g of oyster tissue were found to be 0.008-0.423 micrograms and 0.025-2.077 micrograms, respectively. Tests to study the applicability of the technique as an identifier of petroleum contamination were conducted on tissues of oysters collected from the Seto Naikai coast. Mass fragmentograms of oyster tissue were very similar to those of grade-A crude oil. The technique works well for assessment of long-term effects on marine organisms and environmental samples exposed to chronic low-level discharges of petroleum. (Geiger-FRC)
W81-00437

PRIORITY POLLUTANT ANALYSES OF INDUSTRIAL WASTEWATERS USING A MICROEXTRACTION APPROACH,
Southwest Research Inst., San Antonio, TX. Dept. of Environmental Sciences.
J. W. Rhoades, and C. P. Nulton.
Journal of Environmental Science and Health (A), Vol 15, No 5, Special Issue, p 467-484, 1980. 1 Fig, 2 Tab, 9 Ref.

Descriptors: *Microextraction, *Pollutant identification, *Aromatic compounds, Gas chromatography, Organic wastes, Analytical techniques, Separation techniques, Water pollution sources, Chemical wastes, Plastics, Industrial wastes, Phenols, Waste water(Pollution), Laboratory tests.

A microextraction procedure for analyzing priority-pollutant volatile aromatics, phthalates, polynuclear aromatics, and phenols in waste water was tested on a variety of process waters and effluents from the plastics and organic chemistry industries by the EPA during verification analyses. The extraction was a one-step method in which the solvent: waste water ratio ranged from 1:40 to 1:100. Benzene, toluene, and ethylbenzene were extracted with pentane, and polynuclear aromatic hydrocarbons and phthalates were extracted with hexane. Waste water analyzed for phenols first underwent a base-neutral extraction using methylene chloride and diisopropyl ether. Gas chromatographic analysis was then performed. Comparisons of microextraction results with exhaustive extraction results showed that less variability in spike recoveries and in duplicate analyses occurred with the microextraction method. Data from the analysis for phenols indicated that exhaustive extraction did not necessarily lead to higher recoveries and that high extraction efficiencies (> 70%) were not essential for achieving reliable analyses. Single-step extraction allows the analyst to extract selectively the analyte of interest with relative ease. Microextraction also minimizes false positives, difficulties caused by emulsions, and the necessity for column cleanup. (Geiger-FRC)
W81-00445

EXPERIMENTAL APPLICATION OF GAS CHROMATOGRAPHIC HEADSPACE ANALYSIS TO PRIORITY POLLUTANTS,
Greenwood Lab., Kennett Square.

G. R. Umbreit, and R. L. Grob.
Journal of Environmental Science and Health (A), Vol 15, No 5, Special Issue, p 429-466, 1980. 2 Fig, 1 Tab, 45 Ref, 1 Append.

Descriptors: *Gas chromatography, *Organic wastes, *Pollutant identification, Volatility, Water pollution sources, Aromatic compounds, Storage, Headspace gas analysis, Analytical techniques, Laboratory tests, Chlorides, Sealants, Separation techniques.

The analysis of headspace gases is useful in determining volatile organics present as pollutants in water in which the aqueous phase is equilibrated with an inert gas phase, usually of equal volume. The gas phase of the contaminant is extracted by a gas and subsequently analyzed by gas chromatography. The theories and procedures for headspace gas analysis are reviewed. Pre-experiment tests using three separate samples containing vinyl chloride, methyl chloride, and ethyl chloride showed that distilled water caused an unknown interference, so tap water was used for the remainder of the analyses. Storage studies on these three volatile organics gave evidence that stability was sufficient for = or > 3 days. Samples containing vinyl chloride, methyl chloride, or ethyl chloride were sealed with Hycar or Teflon septums and analyzed at various intervals over the course of 16 days. No differences were found between the performance of the two types of seals, and both were found to maintain stability of the samples under conditions and in the time periods used. The total range of variation increased with increasing storage times. The present method has been applied to the determination of benzene, toluene, xylenes, and chlorobenzene at levels < or = 10 micrograms/liter and carbon tetrachloride, 1,1,1-trichloroethane, chloroform, bromoform, dichlorobromomethane, dibromochloromethane, trichloroethylene, and tetrachloroethylene at < or = 1 microgram/liter. (Geiger-FRC)
W81-00446

ESTIMATED APPLICATION OF GAS CHROMATOGRAPHIC HEADSPACE ANALYSIS TO PRIORITY POLLUTANTS,
Catalytic, Inc., Philadelphia, PA. Environmental Systems Div.
W. F. Cowen, and R. K. Baynes.
Journal of Environmental Science and Health (A), Vol 15, No 5, Special Issue, p 413-427, 1980. 4 Tab, 18 Ref.

Descriptors: *Gas chromatography, *Pollutant identification, *Water pollution sources, Organic wastes, Headspace gas analysis, Volatility, Aromatic compounds, Separation techniques, Laboratory tests, Analytical techniques.

The application of a gas chromatography headspace technique to the determination of EPA priority pollutants was examined. Preselected conditions for all estimates of headspace gas levels included a temperature of 25C, equal volumes of headspace gas and liquid phases, no significant ionic strength or salting out effects, a simple binary (pollutant-water) system, and an initial priority pollutant level of 5 micrograms/liter. Theoretical distribution coefficients were calculated from vapor pressure and aqueous solubility values found in the literature. Estimated headspace gas concentrations for 26 priority pollutants are compared to instrument detection limits obtained from flame ionization, electron capture detectors, and Hall electrolytic conductivity methods. Of the 33 purgeable priority pollutants estimated as amenable to headspace determination at an aqueous concentration of 5 micrograms/liter, only acrolein, acrylonitrile, 2-chloroethyl vinyl ether, and 1,3-dichloropropene remain questionable for this type of analysis. (Geiger-FRC)
W81-00447

APPROACH TO QUALITY ASSURANCE/QUALITY CONTROL IN THE ORGANIC CHEMICALS INDUSTRY MONITORING PROGRAM,
Environmental Protection Agency, Washington, DC. Effluent Guidelines Div.
P. W. Holtzclaw, and M. D. Neptune.
Journal of Environmental Science and Health (A), Vol 15, No 5, Special Issue, p 525-543, 1980.

Descriptors: *Industrial wastes, *Quality control, *Water quality standards, *Organic wastes, Testing procedures, Water pollution, Water analysis, Clean Water Act, Water pollution control, Legislation, Analytical techniques, Monitoring, Toxins.

In 1977, the Clean Water Act called for the development of guidelines to control specific toxic pollutants in industrial discharges. New analytical procedures have been formulated to meet this mandate, and quality assurance (QA) and quality control (QC) programs have been devised to provide data on the precision and accuracy of the analytical results. QA procedures encompass the total program which ensures the consistency and reliability of results. QC procedures are collective routine actions taken to provide QA in the laboratory. A QA/QC plan was designed for the Organic Chemicals Branch which had placed upon it a 2-wk period for method refinement and a rapid turnaround of samples during a 3-day sampling episode to simulate heavy workload conditions. Spiking and recovery studies were repeatedly employed to overcome the problems of variability in waste waters. The program was composed heavily of QA measures, but the quality of the generated data was known by the end of the study. Changes in the objectives or use of the data would necessitate changes in QA formats. Other programs may not require such QA measures, so before a QA/QC plan is initiated, available resources and projected use of data to be generated should be carefully considered. (Geiger-FRC)
W81-00451

ANALYTICAL PROBLEM SOLVING WITH VERIFICATION SAMPLES INTERFERENCE REDUCTION OPTIONS,
PJB Laboratories/Jacobs Engineering, Pasadena, CA.
For primary bibliographic entry see Field 5A.
W81-00452

AN EVALUATION OF FACTORS AFFECTING THE MICROEXTRACTION OF BENZENE, TOLUENE, ETHYLBENZENE AND O-XYLENE INTO PENTANE,
Little (Arthur D.), Inc., Cambridge, MA.
K. E. Thrun, K. E. Simmons, and J. E. Oberholtzer.
Journal of Environmental Science and Health (A), Vol 15, No 5, Special Issue, p 485-501, 1980. 6 Fig, 6 Tab, 2 Ref.

Descriptors: *Microextraction, *Solvent extractions, *Aromatic compounds, Evaluation, Volatility, Gas chromatography, Water pollution treatment, Analytical techniques, Pollutant identification, Water pollution sources, Separation techniques, Organic compounds, Laboratory tests.

Factors affecting the efficiency of a microextraction method to extract benzene, toluene, ethylbenzene, and o-xylene from water into pentane were examined. Quantitative analyses using microextractions are subject to loss of organic extracts through dissolution in the aqueous phase and volatilization. Also, since microextraction is usually done with a high sample:solvent ratio, compounds that do not partition readily into the organic phase will not be extracted as well. The present technique was designed to circumvent these problems. Two sample to solvent ratios (20:1 and 100:1) and various organic solvents were tested to see if comparable results could be obtained. The effects of salting out with sodium sulfate and the presence of other organics in the matrix were also studied. Samples were analyzed by gas chromatography with flame-ionization detection. Results of microextraction efficiencies were in good agreement with values estimated from published partition coefficients. Benzene was the least well extracted of the materials tested, though salting out with sodium sulfate significantly increased recoveries of this compound. Recoveries were generally lowered when the water-soluble organic acetonitrile was present, but this effect could be counteracted by saturation of the aqueous phase with sodium sulfate. Application of the microextraction technique to other priority pollutants seems to be limited by the partition coefficient. (Geiger-FRC)
W81-00453

CHARACTERISTICS OF GEL CHROMATOGRAPHY USING SEPHADEX GEL FOR FRACTIONATION OF SOLUBLE ORGANIC POLLUTANTS,
Yokohama National Univ. (Japan). Dept. of Safety and Environmental Engineering.
K. Urano, K. Katagiri, and K. Kawamoto.
Water Research, Vol 14, No 7, p 741-745, July, 1980. 9 Fig, 1 Tab, 8 Ref.

Descriptors: *Waste water treatment, *Chromatography, *Pollutant identification, Aromatic compounds, Spectrophotometry, Organic wastes, Gels, Analytical techniques, Separation techniques, Laboratory tests, Water pollution sources, Flow rates, Chemical properties.

Sephadex gel chromatography has recently become a feasible technique for the analysis of organic pollutants in waste water during treatment processes. Aqueous solutions kof 46 oranic compounds including organic polymers as well as low molecular weight compounds were chromatographed on Sephadex G-15 and G-25 columns. Eluted materials were measured by spectrophotometry for aromatic compounds and by total organic carbon analysis for non-aromatic compounds. The influence of water flow rate on the outcome of chromatograms and data reproducibility was studied on polyethyleneglycol (PEG)-1000, butyric acid, and phenol at flow rates of 0.2, 0.4, or 0.6 ml/min. Little difference (< 7%) was observed among peaks generated at different flow rates, so subsequent tests were run at a flow rate of 0.4 ml/min. Compounds having structures similar to PEG, sugars, and glycines displayed increased elution volumes as molecular weights decreased. However, this conventional relationship did not apply to many of the lower molecular weight compounds studied. In the case of aliphatic alcohols, aldehydes, carboxylic acids, sulfonic acids, ketones, and aromatic sulfonic acids, elution volumes increased with increasing molecular weights or carbon numbers. Results indicated that elution volume depended upon the chemical structure of the organic compound, because this determines the affinity of the molecule for Sephadex gel and water. (Geiger-FRC)
W81-00493

PARTICULAR SOLUTIONS TO THE PROBLEM OF HORIZONTAL FLOW OF WATER AND AIR THROUGH POROUS MEDIA NEAR A WETTING FRONT,
Cold Regions Research and Engineering Lab., Hanover, NH.
Y. Nakano.
Advances in Water Resources, Vol 3, No 2, p 81-85, June, 1980. 9 Ref.

Descriptors: *Unsaturated flow, *Fluid mechanics, *Air-water interfaces, *Mathematical studies, Thermodynamic behavior, Equations, Air circulation, Flow, Physics, Porous media, Darcys law.

Solutions are derived for the horizontal and simultaneous flow of water and air through homogeneous porous media near a wetting front. Two cases of the Cauchy problem of water movement are examined, the one-phase flow, in which movement of air is negligible or unrestricted, and the two-phase flow, where the effects of air flow on water flow are significant. Regularity properties are compared, and the effects of air flow on water flow are discussed. In one-phase flow problems, the wetting front, defined as the interface between dry and partially saturated parts of media, becomes an acceleration wave. The two-phase flow problem indicates that an interaction between water and air occurs near the wetting front. Singularity occurs in the solutions at the wetting front in both one- and two-phase problems. However, the one-phase flow solution only approximates the two-phase flow solution when saturation is minimal. The solutions support observations on various related initial

value problems which suggest that the system is in the intermediate asymptotic state and far from thermodynamic equilibrium. (Titus-FRC)
W81-00496

7C. Evaluation, Processing and Publication

WATER RESOURCES DATA FOR MAINE, WATER YEAR 1979,
Geological Survey, Augusta, Maine, Water Resources Division.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-120925, Price codes: A11 in paper copy, A01 in microfiche. Geological Survey Water-Data Report ME-79-1, August 1980. 228 p, 3 Fig.

Descriptors: *Maine, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1979 water year for Maine consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of wells. This report contains discharge records for 69 gaging stations, stage only for 2 gaging stations, contents for 17 lakes and reservoirs, water quality for 13 gaging stations and 27 wells, and water levels for 21 observation wells. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies. (USGS)
W81-00343

WATER RESOURCES DATA FOR GEORGIA, WATER YEAR 1979,
Geological Survey, Doraville, GA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-120933, Price codes: A22 in paper copy, A01 in microfiche. Geological Survey Water-Data Report GA-79-1, July 1980. 501 p, 9 Fig.

Descriptors: *Georgia, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1979 water year for Georgia consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and ground-water levels. This report contains discharge records for 100 gaging stations; stage for 10 gaging stations; stage and contents for 17 lakes and reservoirs; water quality for 25 continuous stations, 151 periodic stations and miscellaneous sites; peak stage and discharge only for 98 crest-stage partial-record stations and 12 miscellaneous sites; measurements of discharge at 110 low-flow partial-record stations and 21 miscellaneous sites; and water levels of 28 observation wells. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Georgia. (USGS)
W81-00344

WATER RESOURCES DATA FOR NEW JERSEY, WATER YEAR 1979--VOLUME 1. ATLANTIC SLOPE BASINS, HUDSON RIVER TO CAPE MAY,
Geological Survey, Trenton, NJ. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-119802, Price codes: A16 in paper copy, A01 in microfiche. Geological Survey Water-Data Report NJ-79-1, July 1980. 347 p, 6 Fig, 3 Tab, 36 Ref.

Descriptors: *New Jersey, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Atlantic Slope basins(NJ).

Water resources data for the 1979 water year for New Jersey consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This volume of the report contains discharge records for 75 gaging stations, tide summaries for 1 station; stage and contents for 15 lakes and reservoirs, water quality for 111 surface water sites and 110 wells, and water levels for 35 observation wells. Also included are data for 44 crest-stage partial-record stations and 47 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in New Jersey. (USGS)
W81-00347

WATER RESOURCES DATA FOR NEW JERSEY, WATER YEAR 1979--VOLUME 2. DELAWARE RIVER BASIN AND TRIBUTARIES TO DELAWARE BAY,
Geological Survey, Trenton, NJ. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-119810, Price codes: A11 in paper copy, A01 in microfiche. Geological Survey Water-Data Report NJ-79-2, July 1980. 231 p, 6 Fig, 3 Tab, 36 Ref.

Descriptors: *New Jersey, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Delaware River basin(NJ), Delaware Bay tributaries(NJ).

Water resources data for the 1979 water year for New Jersey consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This volume of the report contains discharge records for 27 gaging stations, tide summaries for 3 stations, stage and contents for 16 lakes and reservoirs, water quality for 86 surface water sites and 65 wells, and water levels for 16 observation wells. Also included are data for 27 crest-stage partial-record stations and 25 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by U.S. Geological Survey and cooperating State and Federal agencies in New Jersey. (USGS)
W81-00348

UNITED STATES GEOLOGICAL SURVEY YEARBOOK, FISCAL YEAR 1979.
Geological Survey, Reston, VA.
1980. 169 p.

Descriptors: *Reviews, *Annual, *Projects, *Data collections, *Natural resources, Water resources, Water quality, Energy, Mapping, Geological surveys, Landslides, Mineralogy, Land management, Indian reservations, Coals, Oil industry, Programs, Administration, Cost allocation, Budgeting, U.S. Geological Survey.

The fiscal year 1979 Yearbook summarizes the activities of the U.S Geological Survey in response to its scientific and regulatory missions and its responsibility for exploration of the National Petroleum Reserve in Alaska. The main sections of this Yearbook are: (1) The Year in Review--a brief overview of the significant events of the Geological Survey during fiscal year 1979; (2) Perspectives--essays focusing on specific events (rather than scientific topics) and programs involving multi-Division participation; (3) Missions, Organization, and Budget--a description of the Geological Survey's major duties and assignments and of the organizational structure that supports its missions; (4) Division Chapters--a description of the significant accomplishments (rather than a comprehensive program by program discussion) of each of the mine operating Divisions and offices; and (5) Appendices--provide supplementary information regarding key personnel, cooperators, and selected summary budgetary tables and an index. (USGS)
W81-00352

HYDROLOGIC AND LAND-COVER FEATURES OF THE CALOOSAHATCHEE RIVER BASIN, LAKE OKEECHOBEE TO FRANKLIN LOCK, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
H. H. LaRose, and B. F. McPherson.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225, paper copy $3.50, microfiche $0.50. Geological Survey Open-File Report 80-732 (WRI), 1980. 1 Sheet, 2 Fig, 1 Tab, 5 Ref.

Descriptors: *Maps, *River basins, *Freshwater, *Surface waters, *Florida, Streamflow, Canals, Land use, Agriculture, Water quality, *Caloosahatchie River(Fl).

The freshwater part of the Caloosahatchee River basin, Fla., from Franklin Lock to Lake Okeechobee, is shown at a scale of 1 inch equals 1 mile on an aerial photomosaic, dated January 1979. The basin is divided into 16 subbasins, and the land cover and land use in each subbasin are given. The basin is predominantly rangeland and agricultural land. Surface-water flow in the basin is largely controlled. Some selected data on water quality are given. (USGS)
W81-00353

HYDROLOGIC DATA FROM UPPER GRANGE HALL CREEK BASIN, NORTHGLENN, ADAMS COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
D. C. Hall, and A. C. Duncan.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, Co. 80225. Paper copy $17.75, microfiche $3.50. Geological Survey Open-File Report 80-578, 1980. 132 p, 2 Fig, 34 Tab, 10 Ref.

Descriptors: *Hydrologic data, *Streamflow, *Surface runoff, *Watersheds(Basins), *Colorado, Groundwater resources, Rainfall, Snowmelt, Sediment transport, Water quality, Water analysis, Data collections, *Northglenn(CO), *Adams County(CO), *Grange Hall Creek(CO), *South Platte River basin(CO).

Hydrologic data collected during 1977-79 as part of a water-resources investigation of storm runoff in Upper Grange Hall Creek basin, Adams County, Colo., are presented in this report. Data presented in tabular form consist of: (1) Estimated daily precipitation at one site (April through October, 1978 and 1979); (2) mean daily streamflow at two sites (December 1977 through September 1979); (3) instantaneous streamflow at two sites along Grange Hall Creek and corresponding cumulative rainfall at one to three sites for 17 storms (April 1, 1978, to August 26, 1979); (4) concentrations of selected major ions, fecal-coliform bacteria, suspended sediment, nutrients, and trace elements at five sites during dry-weather flow, at three sites during rainfall runoff, and at five sites during snowmelt runoff; and (5) concentrations of pesticides and polychlorinated biphenyls at two sites during dry-weather flow and rainfall runoff. (USGS)
W81-00366

ECOLOGICAL IMPACT ASSESSMENT,
J. M. Baker.
Marine Environmental Research, Vol 3, No 4, p

245-248, September, 1980. 1 Fig, 3 Ref.

Descriptors: *Industries, *Ecology, *Data collections, *Effluents, On-site data collections, Toxicity, Water pollution, Chemical analysis, Path of pollutants, Sampling, Biology, Adaptation, Water pollution control, Pollutants.

Approaches to ecological impact assessment of industrial developments may be viewed as continuing processes, rather than as complete sets of predictions. One known method of evaluating the impact of industrial development takes into consideration everything in the system, while another consists of data gathering toward an end product which is little more than a literature search. The present approach differs from these two schemes in that ecological impact predictions are treated as hypotheses that must be tested by experimental techniques, and industrial development itself is regarded as a large field test, the outcome of which is not yet known. Monitoring for existing sites is essential in assessing ecological impact. Examples of objectives and monitoring approaches in this system are comparison of effluents with statutory chemical specifications (chemical analyses), information on toxicity of effluents at discharge point or water in receiving area (lethality tests), detection of changes in species combination and abundance (ecological surveys), and information on the movement, fate, and uptake by organisms of pollutants (chemical analyses of water, sediment, and tissue). Quantitative biological sampling from sites of chronic discharge has proven fruitful. Field experiments are an alternate method that has been of great use in the monitoring of oil spills. (Geiger-FRC)
W81-00416

8. ENGINEERING WORKS

8A. Structures

TENNESSEE-TOMBIGBEE WATERWAY: PLANNING HISTORY,
Army Engineer District, Mobile, AL.
F. L. Currie.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25 September 1979. p 1-3, (1979).

Descriptors: *Tennessee-Tombigbee Waterway, *Tennessee River, *Tombigbee River, *Inland waterways, Canals, Canal design, Civil engineering, Locks, Navigation, Transportation, History, Project planning, Alabama.

An efficient waterway connecting the north-flowing Tennessee River with the south-flowing Tombigbee River to provide a continuous waterway from the Tennessee, Upper Mississippi, and Ohio Valleys to Mobile on the Gulf of Mexico is finally becoming a reality many years after it was first envisioned in the early 1700's. In 1819 Alabama had the project surveyed and in 1826 a company was chartered for the canal construction. The arrival of the railroad and right-of-way difficulties with the Cherokee Indians halted this attempt. In 1875 Congress authorized a survey of the project and a route was selected however, the report concluded that the route would only be usable during flood seasons. Following improvements on both rivers, another route was proposed by the Corps of Engineers in the early 1900's that would be usable year round but, due to excavation requirements this plan was also abandoned. In the 1930's the waterway idea once again was considered. In 1946 Congress authorized the Tennessee-Tombigbee Waterway but no funding was provided. The waterway was reevaluated in 1957 and in 1965. Finally in 1971 funds were appropriated for construction. (See also W81-00290) (Seigler-IPA)
W81-00291

TENNESSEE-TOMBIGBEE WATERWAY PROJECT DESIGN AND CONSTRUCTION ACTIVITY,
Army Engineer District, Mobile, AL.
F. G. Thompson.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25 September 1979. p 5-7 (1979) 3 Fig.

Descriptors: *Tennessee-Tombigbee Waterway, *Inland waterways, *Tennessee River, *Tombigbee River, Project planning, Canals, Canal design, Civil engineering, Locks, Navigation, Transportation, Environmental effects, Dredging, Locks, Engineering structures.

After a long period of planning, design, and construction, the Tennessee-Tombigbee Waterway is now scheduled to open for navigation in mid-1984. The Waterway will provide a shortened route between shipping points in mid-America and the deepwater ports of the Gulf coast. It will connect the Tennessee River at Pickwick Lake with the Tombigbee River at Demopolis, a water level difference of 341 feet. The Waterway has three sections; the 148 mile River Section, the 44 mile Canal Section, and the 40 mile Divide Section. Major structures on the River Section include the Demopolis Lock and Dam, the Gainesville Lock and Dam, the Aliceville Lock and Dam, the Columbus Lock and Dam, and the Aberdeen Lock and Dam. For the Canal Section a channel will be excavated east of the Tombigbee River leaving the river in an essentially natural state. The Canal Section will have five locks for a total lift of 140 feet. The Divide Section cut will require the excavation of 149,700,000 cubic yards of material at a cost of $270,601,206. The Corp of Engineers is placing much emphasis on environmental considerations and inspections are being conducted annually. Actual construction is now about 35% complete. (See also W81-00290) (Seigler-IPA)
W81-00292

TENNESSEE-TOMBIGBEE WATERWAY: PROJECT OPERATION, CULTURAL AND RECREATION RESOURCES DEVELOPMENT,
Army Engineer District, Mobile, AL.
G. L. Melton, J. J. Nielsen, and E. Topper.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25 September 1979. p 9-13 (1979) 5 Fig.

Descriptors: *Tennessee-Tombigbee Waterwsay, *Recreation facilities, *Archaeology, *Operation and maintenance, Canals, Project planning, History, Environmental effects, Inland waterways, Camping, Boating, Swimming, Lakes, Locks.

The cultural resources program for the Tennessee-Tombigbee Waterway is one of the most comprehensive programs of its type. Due to the number and variety of sites found the Tombigbee River Multi-Resource District was approved by the National Register in 1977. Human occupation of the area potentially dates back 12,000 years. It is estimated that sites, both prehistoric and historic, along the waterway probably number into the thousands. Redesign and avoidance procedures will be used to preserve as many sites as possible. Forty-nine recreation sites are planned for the 42,000 water surface acres of the project. Lakes associated with the project will have company areas, day use areas, and boat launching facilities. Two marinas will also be part of the initial recreational development. The initial recreation facilities will be operated and maintained by the Corps of Engineers. The area management office will be in Columbus, Mississippi, with three sub-offices located along the waterway. Due to limited Corps personnel operation and maintenance will be contracted to private enterprise. Descriptions and maps of individual lakes and recreation facilities are provided. (See also W81-00290) (Seigler-IPA)
W81-00293

MISSISSIPPI DAM SAFETY PROGRAM,
Mississippi Dept. of Natural Resources Jackson. Bureau of Land and Water Resources.
J. W. Pepper.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25 September 1979. p 23-25 (1979).

Descriptors: *Mississippi, *Dam failure, *Flood damage, Dams, Dam design, Dam construction, Flood control, Overflow, Spillways, Maximum probable flood, Safety, Safety factors, Inspection, Aerial photography.

In recent years Mississippi has passed laws to locate and remove hazards caused by dams and to require written authorization for future dams with drainage areas of fifty or more acres. There are as many as 125,000 livestock ponds in the State that were built prior to controls. Following the failure of dams such as the Teton Dam in Idaho in 1976 and the Toccoa Falls Dam in Georgia, $15 million was made available for dam inspection. In 1975 high altitude photographs were used to make an inventory of dams capable of storing 50 acre feet or more of water. Dams located where, if they failed, 'more than a few' lives would be endangered were placed in Category I. Seventy dams received this classification although later deletions and additions were made. Upon inspection, dams were considered unsafe if their spillway would not pass 50% of the Probable Maximum Flood without overtopping the dam. The major problems found were inadequate spillways and some dams designed by bulldozer operators had structural problems. Seepage and stability problems were also common. Cooperation from dam owners in making their dams safer was excellent. All unsafe dams have had some work to remedy their problems and much has been done to correct the lack of maintenance. (See also W81-00290) (Seigler-IPA)
W81-00296

PROCESS AND APPARATUS FOR MAINTAINING A DESIRED DEPTH OF A WATERWAY,
C. B. Pekor.
U.S. Patent No 4,189,253, 6 p, 10 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 991, No 3, p 949, February 19, 1980.

Descriptors: *Patents, *Sedimentation, *Channels, Sediment transport, Suspension, Flow control, Channel improvement, Pumps, Jets, Equipment, Channel morphology, Depth, Channel maintenance, Waterways.

A process and apparatus maintains a waterway at a desired depth, the bottom of which is subject to accumulation of sediment such as sand. The process comprises the placement of jet pumps on a vertically movable support together with the step of fluidizing the sediment immediately beneath the pumps so that they sink by gravity at least to the desired depth of the waterway. The process further comprises supplying injection water to the sediment covered pumps and removing the sediment-water slurry from the pump. A support member spans the width of the waterway being mounted for vertical movement relative to the bottom of the waterway. Jet pumps are mounted on the support member so that the entire array may be lowered at least to the desired depth of the waterway. Additionally, the structure on which the pumps are mounted may carry a conduit to which water under pressure is directed to fluidize the bottom, permitting the pumps to be lowered or raised. (Sinha-OEIS)
W81-00375

RANDOM HYDRODYNAMIC FORCE ON DAM FROM EARTHQUAKES,
Delaware Univ., Newark. Dept. of Civil Engineering.
C. Y. Yang, and V. Chiarito.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124166, Price codes: A02 in paper copy, A01 in microfiche. Technical Research Report (1980), 22p, 4 Fig, 5 Tab, 13 Ref. OWRT-A-047-DEL(2), 14-34-0001-0108.

Descriptors: *Dams, *Earthquakes, Hydrodynamics, Forces, Random process, *Dam design, *Gravity dams, Hydraulic structures, Model studies.

A new solution for the hydrodynamic force on gravity dams during earthquakes has been obtained. The horizontal acceleration of earthquakes is modelled by a time-dependent random process and the force response solution is given in terms of non-stationary power spectral density and the mean square function.

W81-00378

SEISMIC RISK ANALYSIS OF WILMINGTON, DELAWARE,
Delaware Univ., Newark. Dept. of Civil Engineering.
C. Y. Yang, and P. Dressel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124166, Price codes: A03 in paper copy, A01 in microfiche. Technical Research Report (1980), 34p, 11 Fig, 4 Tab, 13 Ref. OWRT-A-047-DEL(1), 14-34-0001-0108.

Descriptors: Seismic risk, *Dams, Strengthening dams, Safety analysis, *Earthquakes, *Seismic studies, *Structural engineering, Vibrations, *Concrete dams, Delaware, Wilmington area(DE).

A seismic risk analysis is carried out for Wilmington, Delaware where an old and deteriorating concrete dam is located. The result confirms the prediction by the U.S. Geological Survey showing a risk of about 10% in 50 years for the occurrance of an earthquake ground acceleration of 0.04g. Extensions of predictions provide information for safety planning and strengthening of this dam.
W81-00379

UNDERGROUND RESERVOIRS CAN CONTROL STORMWATER OVERFLOWS,
Randolph and Associates, Inc., Peoria, IL.
For primary bibliographic entry see Field 5F.
W81-00417

WE INSTALL OUR OWN WATER MAINS,
Valparaiso Dept. of Waterworks, IN.
P. A. Coote.
American City and County, Vol 95, No 7, p 61-63, July, 1980. 2 Fig.

Descriptors: *Conduits, *Costs, *Contracts, Construction equipment, Economic planning, Municipal water, Water management(Applied), Administration, Installation costs, Construction costs, Legal aspects, Contract administration.

Details of the contract which Valparaiso's Department of Waterworks draws up with contractors for the installation of water mains are discussed. Added onto labor costs are the rental costs of excavators, other rental equipment, pressure testing, administrative costs, and 10% profit for the department. A typical job with a footage of 1,210 ft requires 106 hr and has an estimated cost of $3.70/ft. Actual costs has been $2.60/ft. Factors that led to the decision for the Department to do their own construction included departmental control over the pipe and fitting installation, the fact that crews had a thorough knowledge of the system, and the ability to maintain qualified personnel on the job. (McKeon-FRC)
W81-00433

8B. Hydraulics

INVESTIGATION OF A SURFACE RESISTIVITY TECHNIQUE FOR THE ESTIMATION OF HYDRAULIC CONDUCTIVITY IN STRATIFIED DRIFT AQUIFERS,
Connecticut Univ., Storrs. Dept. of Geology and Geophysics.
D. Scott.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-120594, Price codes: A06 in paper copy, A01 in microfiche. M.S. Thesis, 1980. 98 p, 17 Fig, 1 Tab, 73 Ref. OWRT-A-077-CONN(s), 14-34-0001-7014.

Descriptors: Surface resistivity technique, *New England, *Hydraulic conductivity, *Aquifers, Stratigraphy, Sands, Gravels, Water wells, Test wells, Model studies, Least squares method, Groundwater movement.

A least squares regression line correlating hydraulic conductivity with apparent formation factor of aquifers in sand and gravel (generally thought to be stratified drift in the cases discussed) is presented. Nineteen aquifers in southern New England were studied. Schlumberger vertical electrical soundings (VES) were conducted at water well sites for which pump test data were available. VES curves were automatically inverted and a value of aquifer resistivity was determined from the total longitudinal conductance of the resulting earth model. Methods for the interpretation of pump test data from water table and leaky artesian aquifers are discussed. The ratio of vertical to horizontal hydraulic conductivity averaged one to twenty-seven in the aquifers studied.
W81-00267

PROCEEDINGS, 14TH ANNUAL MISSISSIPPI WATER RESOURCES CONFERENCE, 24-25 SEPTEMBER 1979,
For primary bibliographic entry see Field 2E.
W81-00290

REAERATION TESTS, ENID LAKE OUTLET WORKS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
C. H. Tate.
In: Proceedings, 14th Annual Mississippi Water Resources Conference, 24-25, September 1979. p 91-95, (1979) 3 Fig, 1 Append.

Descriptors: *Oxygenation, *Water properties, *Aeration, *Radioactive tracers, Spillways, Liquid scintillation counters, Gases, Mississippi, Reservoirs, Water quality, Water chemistry, Chemical analysis, Sampling, Water analysis, Mississippi, *Enid Lake(MS).

The radioactive gas tracer technique developed by Dr. E. C. Tsivoglou was used to measure the gas transfer characteristics at the outlet structure of Enid Lake on the Yocona River in northern Mississippi. The lake has an earth fill dam 8,400 ft long and 293 ft high. Two eleven ft-diameter concrete conduits pass water through the base of the dam to the concrete paved spillway. For testing the stream was dosed upstream with three tracing elements. Krypton-85, a radioactive tracer, measures gas transfer between the water and the atmosphere. Tritium, also rdioactive, was used to measure the dispersion of the dose in the water. Rhodamine-wt dye indicated the presence of the radioactive trcers at the sampling stations. Samples were analyzed for radioactive concentrations using a liquid scintillation counter. The four sampling stations used were located at the emergency gate slot, the outlet portal, the entrance to the tailwater, and over the sill. Due to equipment problems only six of the planned eight doses were released. Results from the six released show that tracer samples can be collected at hydraulic structures and small changes in gas transfer can be detected. Data summaries are presented in an appendix. (See also W81-00290) (Seigler-IPA)
W81-00308

CHANNEL AND DYNAMIC FLOW CHARACTERISTICS OF THE CHATTAHOOCHEE RIVER, BUFORD DAM TO GEORGIA HIGHWAY 141,
Geological Survey, Doraville, GA. Water Resources Div.
R. E. Faye, and R. N. Cherry.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.25. Geological Survey Water-Supply Paper 2063, 1980. 66 p, 22 Fig, 13 Tab, 11 Ref.

Descriptors: *Open channel flow, *Unsteady flow, *Flow characteristics, *Georgia, *Model studies, Mathematical models, Numerical analysis, Stage-discharge relations, Streamflow, Discharge(Water), Hydraulics, Mannings equation, Roughness(Hydraulic), Equations, Digital computers, Energy gradient, Cross-section, Hysteresis, *Chattahoochee River(GA).

Detailed flow and cross-section data for a 17-mile reach of the Chattahoochee River in northeast Georgia are described and summarized. Flow data include measurements of highly dynamic stage and discharge at five stations during the period March 21-23, 1976. Flow data were collected at 5-minute intervals and are listed accordingly. Coordinate data for 39 cross sections in the study reach are also listed. A mathematical model is developed and applied whereby stage data collected at a single station can be used to compute highly dynamic discharge at the station. The model is based on the continuity and momentum equations that described unsteady, one-dimensional flow in open channels. Both equations are transformed to a single quadratic equation which describes mean flow velocity at a single station. Flow-geometry parameters used by the model are computed using cross-section coordinates and the equation which describes the area of an irregular polyon. Use of the model in conjunction with highly dynamic stage data collected on March 23, 1976, provided close agreement between measured and computed discharges. The model was also used to investigate the sensitivity of highly dynamic discharge to channel and flow parameters. Computed dicharge was mot sensitive to changes in channel roughness and slope. (USGS)
W81-00362

SURGE TANK WATER LEVEL VARIATIONS FOLLOWING RAPID VALVE OPENING,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Civil Engineering and Building Technology.
For primary bibliographic entry see Field 7B.
W81-00409

ASPECTS OF RIVER MORPHOLOGY,
Inland Waters Directorate, Winnipeg (Manitoba).
R. W. Newbury.
In: Proceedings of the Technology Transfer Workshop, Environmental Impact Assessment in the North, Oct 31, Nov 1-2, 1978. Inland Waters p, 12, 1979. Directorate, Ottawa, Ontario, Canada, Technical Workshop Seris No.

Descriptors: *Rivers, *Channel morphology, *Environmental effects, *Manitoba, Churchill River, Nelson River, Southern Indian Lake, Water levels, River flow, River systems, Drainage, Watershed management, Canada.

Central to the writer's view of river morphology is a concept of fitness - a concept most difficult to describe since it cannot be defined precisely, but is still based in science. Fitness in natural system describes how one system fits with others, how well it blends into a unified whole. Environmental impacts are deviations from this natural fit. Development of drainage networks, which are analogous to other natural network such as those of trees and blood vessels. The ratios of branch order and branch length remain constant regardless of basin size. A second concept of fitness examines the vertical distribution in a river system and addresses a concept of stream power. It states that equal segments of river channel in unconsolidated materials generate equal amount s of power. IN typical, upwardly concave profiles, the headwater segments have greater head but less water than lower segments. Natural river systems will work towards the re-establishment of this equilibrium when man introduces changes in the regime. Two examples of misfit systems in Northern Manitobs are the diversion of Churchill River into a headwater on the Nelson River, and the raising of southern Indian Lake water levels. In a geologic time-frame, these perturbations are of no consequence, but in the short run of 50 to 100 years, a normal planning horizon for larger-scale development, they creat rather severe environmenment impact. (WATDOC)
W81-00460

8I. Fisheries Engineering

NIGHTLY AERATION TO INCREASE PRODUCTION OF CHANNEL CATFISH,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
W. D. Hollerman, and C. E. Boyd.
Transactions of the American Fisheries Society,

Vol 109, p 446-452, 1980. 5 Fig, 5 Tab, 16 Ref. OWRT B-076-ALA(6), 14-34-0001-9101.

Descriptors: *Channel catfish, *Aeration, Dissolved oxygen, *Fish management, Ponds, Fish behavior, Unaerated ponds, Aerated ponds, Fish, Growth rates.

Channel catfish (Ictalurus punctatus) were stocked in 0.02- and 0.04-hectare ponds at 20,385 fish per hectare and fed daily. Fish averaged 11 cm total length and 6.2 g at stocking. Six ponds received nightly aeration (2 to 6 hours) and six ponds received no aeration. A maximum feeding rate of 90 kg/hectare was reached in October. In aerated ponds, no dissolved oxygen (DO) problems occurred, and survival was 92%. Fish mortalities resulted from DO depletion in all unaerated ponds, and survival was 40%. Nitrite-nitrogen concentrations were significantly higher in the aerated ponds, though never at levels reported as lethal to channel catfish. Concentrations of un-ionized ammonia were high enough in both aerated and unaerated ponds to have adversely affected growth. Aerated ponds yielded an average of 5,307 kg/hectare of channel catfish and had a net economic gain of $1,500 per hectare. The unaerated ponds yielded an average of 1,400 kg/hectare and were an obvious economic failure. Direct extrapolation of economic data to large commercial ponds is not advised.
W81-00268

9. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

WATER RESOURCES IN NORTH CAROLINA,
North Carolina Water Resources Research Inst., Raleigh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127318, Price codes: A04 in paper copy, A01 in microfiche. Annual Report, No UNC-WRRI-80-00, 1980. 68 p, 31 Fig. OWRT-A-999-NC(53).

Descriptors: *North Carolina, *Research priorities, *Chowan River, Eutrophication, Grants, Planning, Water resources, Water conservation, Agriculture, Research and Development, Information exchange, Projects, Reservoirs, Pulpmills, Waste water treatment.

The Institute supported 35 research projects during the year covering topics such as algal blooms on the Chowan River, the effects of large-scale agricultural development, the quality of the planned B. Everett Jordan Reservoir, water conservation, and wetlands protection. The nuisance blooms on the Chowan are one of the State's most serious and baffling environmental problems. The Chowan has too many nutrients from many sources. The Institute identifies needs, motivates and supports research, and promotes technology transfer. Water resources planning is another major concern of the Institute. New projects recently begun include: the hydrologic impacts of peat mining, treatment of pulp mill waste water, hydrologic and water quality models for in stream flow needs, and paper mill discharge effects on the Neuse. Institute 'mini-grants' funded last year included: appropriation technology and rural water and sanitation needs in the developing countries, groundwater quality at Greensboro's White Street landfill, and the potential for aquiculture in North Carolina. A listing of Institute reports and authors is included. (Seigler-IPA)
W81-00325

9D. Grants, Contracts, and Research Act Allotments

WATER RESOURCES RESEARCH PLAN FOR OREGON FOR THE PERIOD 1982-1987,
Oregon State Univ., Corvallis. Water Resources Research Inst.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-122103, Price codes: A06 in paper copy, A01 in microfiche. Report prepared for Office of Water Research and Technology, October 31, 1980. 112 p, 12 Fig, 2 Tab, 21 Ref.

Descriptors: *Oregon, *Research priorities, *Irrigation water, Water allocation(Policy), Water law, Runoff, Water shortages, Water reuse, Budgeting, Planning, Estuaries, Columbia River, Forests, Watersheds(Basins), Consumptive use, *Five-year plans.

Oregon's major water-related problems involve seasonal, geographic, and year-to-year maldistribution between water supply and competing water uses with recurring water shortage and excessive runoff. The State's largest consumptive use will always be for irrigation but other problem areas include river water quality; lake and reservoir water quality; bays, estuaries, and wetlands; planning and management of water resources; and forested watershed management. Four major categories will be used to classify these problems for research purposes: (1) water use, (2) groundwater, (3) bays, estuaries, and wetlands, and (4) general. Under water use, priority research areas will cover water rights transfers; Columbia River water use; agricultural, municipal, and industrial reuse; and water pricing policies. General problems research will be used to evaluate irrigation systems and application methods and to analyze recent changes in Oregon's water laws and institutions. A listing of problem areas and related studies by Federal and State agencies include priority, agencies participating, scheduling, and funding. Budget information is given by research problem for the years between 1982 and 1987 on two schemes, a $115,000 annual funding and a $135,000 annual funding from the Office of Water Research and Technology. (Seigler-IPA)
W81-00284

FIVE-YEAR WATER RESOURCES RESEARCH AND DEVELOPMENT GOALS AND OBJECTIVES,
South Dakota State University, Brookings. Water Resources Inst.
J. L. Wiersma.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-122061, Price codes: A05 in paper copy, A01 in microfiche. October, 1980. 94 p, 11 Fig, 8 Tab, 26 Ref.

Descriptors: *Research priorities, *South Dakota, *Research and development, *Precipitation(Atmospheric), *Agriculture, *Water resources development, Planning, Project planning, State jurisdiction, Erosion, Runoff, Rainfall intensity, Rain, Dams, Water conservation, Water use, Water quality, Wetlands, State governments, Water rights, Interstate rivers, Missouri River, *Five-year plans.

The five-year program was developed from a review of South Dakota water resources activities and issues. Water problems were concluded to revolve basically about a nonuniform and deficient annual precipitation, capable of producing storms of unusual intensity, for this principally agricultural State. Agriculture controls the basic research needs, requiring dependence on a judicious use and conservation of water resources. Potential water use exceeds that received by precipitation. Runoff-erosion processes that transport contaminants to surface water represent an additional concern. Since a documented State water plan has been lacking, the development of a base by researchers for proper decision-making was deemed important. The principal problems requiring research and resolution relate to sporatic and insufficient rainfall; transportation needs for available fresh water in Missouri River dams; and water use rights. The five-year plan has detailed proposed activities related to seven State water problem categories: (1) water quantity management; (2) conservation and efficient use; (3) water quality; (4) legal/institution/social/economic problems; (5) supply; (6) water-energy relationships; and (7) wetlands. Nineteen primary, nine secondary, and six tertiary priorities were identified for these categories, with water supply having the highest number (five) of primary priorities. Research approaches were formulated for the identified priorities. (Zielinski-IPA)
W81-00288

FIVE-YEAR WATER RESOURCES RESEARCH AND DEVELOPMENT PLAN: FISCAL YEARS 1982-1986,
Mississippi State Univ., Mississippi State. Water Resources Research Inst.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-126518, Price codes: A07 in paper copy, A01 in microfiche. Report submitted to Office of Water Research and Technology, 1980. 133 p, 6 Fig, 9 Tab, 66 Ref, 2 Append. 14-34-0001-0126.

Descriptors: *Research priorities, *Mississippi, *Water resources development, *Planning, *Water resources institute, Organizations, Water sources, State jurisdiction, State governments, Water supply, Research and development, Runoff, Storm runoff, Mississippi River, River basins, Floods, Water reuse, Streams, Droughts, Erosion, Wetlands, *Five-year plans.

The Mississippi Water Resources Research Institute has established a documented list of Mississippi water resources and related land-use problems, which has allowed for the development of prioritized research agenda and the identification of training and technology transfer activities to meet water resources needs. Current related activities by other agencies and organizations were identified and incorporated in the five-year research program. Identified problems include increased water demands causing geographically critical shortages annually; water quality impact on community surface waters by inadequate waste water treatment capacities and stormwater runoff; river basin flooding and erosion/sedimentation; and interstate and industry/municipality/agriculture intrastate conflicts over water use. The eight identified program elements covering on-going/proposed activities addressing these problem areas were: water conservation and reuse; water resources planning and management; maintenance of flows for stream uses; energy development impacts; water requirements for food and fiber production; flood and drought damage; wetlands protection; and water quality protection. (Zielinski-IPA)
W81-00289

WATER RESOURCES RESEARCH SUPPORT PROGRAM 1979-1980,
Inland Waters Directorate, Ottawa (Ontario).
For primary bibliographic entry see Field 6E.
W81-00383

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A03	6.50	E03	8.50	T03	210.00
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A11	18.50	E11	24.50	T11	720.00
A12	20.00	E12	27.50	T12	780.00
A13	21.50	E13	30.50	T13	840.00
A14	23.00	E14	33.50	T14	900.00
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